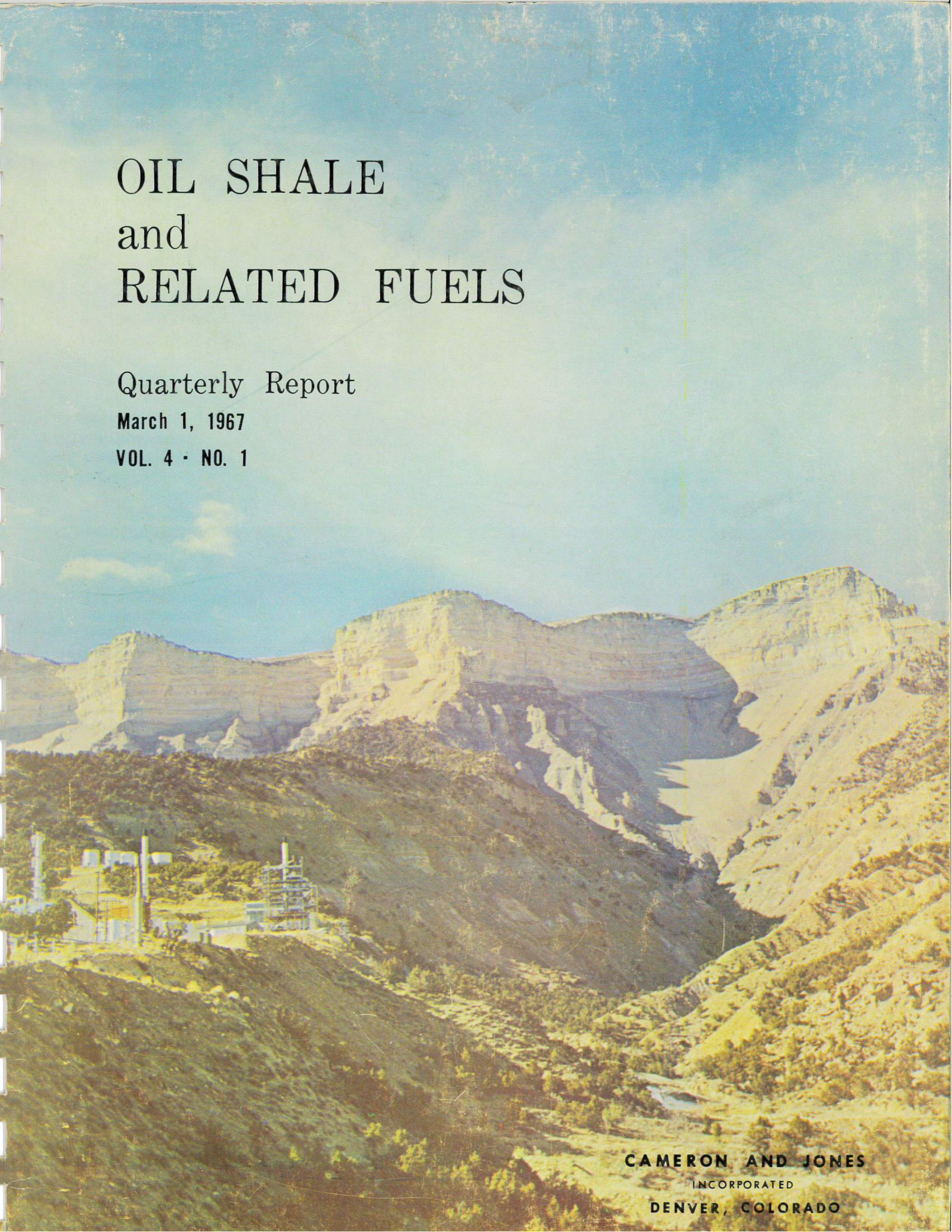
OIL SHALE and RELATED FUELS

Quarterly Report

March 1, 1967
VOL. 4 · NO. 1



CAMERON AND JONES
INCORPORATED
DENVER, COLORADO

OIL SHALE
and
RELATED FUELS

Quarterly Report

March 1, 1967

© 1967 by CAMERON AND JONES, INCORPORATED

VOLUME 4, NUMBER 1

TABLE OF CONTENTS

Page

HIGHLIGHTS vii

COMING EVENTS xi

RECENT PUBLICATIONS OF INTEREST xvi

Special Feature

THE FEDERAL FIVE-POINT OIL SHALE DEVELOPMENT PROGRAM

SECRETARY UDALL ANNOUNCES FEDERAL OIL SHALE PROGRAM 1

SOLICITOR BARRY DISCUSSES, "MINING CLAIMS AND AN OIL SHALE PROGRAM: THE GOVERNMENT'S SEARCH FOR INDUSTRY UNDERSTANDING" 8

SENATE HOLDS HEARINGS ON FEDERAL OIL SHALE PROGRAM 9

I. OIL SHALE

LAND

1930 WITHDRAWAL ORDER RECEIVES COURT TEST 1-1

ASSESSMENT WORK PERFORMANCE RULED UNNECESSARY TO RETAIN PLACER CLAIMS 1-2

PENDING CIVIL ACTION CASES REVIEWED 1-3

WYOMING COMMISSIONER OF PUBLIC LANDS DISCUSSES STATE POLICY 1-3

BUMINES OFFICIAL PREDICTS INDUSTRY WITHIN TEN YEARS 1-5

PLLRC DIRECTOR DISCUSSES DEMAND FOR ENERGY FUELS 1-6

TABLE OF CONTENTS (CONT.)

Page

NEW PLLRC APPOINTMENTS ANNOUNCED 1-7

SASKATCHEWAN PERMITS LISTED 1-9

COLORADO OWNERSHIP MAP UPDATED 1-9

TECHNOLOGY

THE CER GEONUCLEAR PROJECT REVIEWED 1-10

COMMERCIAL NUCLEAR IN SITU PROGRAM EXAMINED 1-16

STEAM THERMAL IN SITU TEST ON

IGT PUBLISHES FINAL REPORT ON HYDROGASIFICATION 1-23

MATHEMATICAL MODEL UTILIZED TO ILLUSTRATE IN SITU PROCESS 1-28

CORPORATIONS

THE OIL SHALE CORPORATION REVIEWED

DENVER RESEARCH INSTITUTE APPOINTS DIRECTOR 1-47

SINCLAIM ACTIVITIES NOTED 1-47

WATER

USGS STUDIES HYDROLOGY IN PICEANCE BASIN 1-48

ADDITIONAL ADJUDICATIONS NOTED 1-49

COLORADO SHALE AREA CLAIMS REVIEWED 1-53

OTHER

SENATE BILL WOULD CREATE DEPARTMENT OF NATURAL RESOURCES 1-72

TABLE OF CONTENTS (CONT.)

Page

FEDERAL WITHDRAWAL OF OIL SHALE LANDS AFFECTS SODIUM LEASING 1-72

WYOMING LAW TO PERMIT SODA MINING ON ALTERNATE SECTIONS 1-72

U. S. ENERGY CONSUMPTION EXPECTED TO DOUBLE IN TWENTY YEARS 1-73

PIPELINING SHALE OIL EXAMINED 1-74

II. TAR SANDS/BITUMINOUS SANDS

LAND

UTAH LEGISLATURE STUDIES COMBINED LEASE FORM 2-1

BITUMINOUS SAND CORPORATION HOLDINGS EXAMINED 2-2

LITTLE CHANGE NOTED IN ALBERTA LEASES 2-7

OTHER

GCOS REQUESTS PRODUCTION INCREASE 2-10

III. COAL AND LIGNITE

NATIONAL DEVELOPMENTS

SLURRY PIPELINE TO TRANSPORT COAL TO NEVADA 3-1

ANOTHER INDEPENDENT COAL COMPANY TALKS MERGER 3-4

NUCLEAR POWER EXPANSION SLOWS 3-5

TABLE OF CONTENTS (CONT.)

Page

NEW CONTRACTS BY THE OFFICE OF COAL RESEARCH CITED 3-5

STATUS OF PROJECTS OF THE OFFICE OF COAL RESEARCH REVIEWED 3-6

REPORTS ISSUED BY OFFICE OF COAL RESEARCH NOTED 3-7

WESTERN DEVELOPMENTS 3-11

COLORADO COAL STATISTICS PRESENTED 3-13

OTHER COLORADO NEWS NOTED 3-17

UTAH ACTIVITIES CONTINUE 3-20

WYOMING LEASES TABULATED 3-22

ARIZONA MAY BE SITE OF A COAL-FIRED POWER PLANT 3-23

WASHINGTON POWER PLANT DUE ON-STREAM IN 1973 3-24

APPENDIX

Reproduction of MEMORANDUM OPINION AND ORDER on Civil Actions Involving Oil Shale Properties, U. S. District Court, December 21, 1966. A-1

United States Department of the Interior News Release: "Five-Point Oil Shale Development Program Announced" A-11

Copy of the January 26, 1967 Application for Withdrawal of Lands Containing Oil Shale A-17

Copy of Letter from Associate Director, BLM and Memorandum Concerning Sodium Leases on oil shale land A-20

TABLE OF CONTENTS (CONT.)

Page

Copy of Notice of Proposed Withdrawal of Oil Shale Lands A-22

Copy of Nathan Report A-23

Copy of Solicitor Barry's Speech entitled *Mining Claims and an Oil Shale Program: The Government's Search for Industry Understanding* A-27

Copy of S.B. 77, Utah State Legislature A-31

Copies of Statements before the U. S. Senate Committee on Interior & Insular Affairs February 21, 1967:

Secretary Stewart L. Udall, with copy of: A-35

Oil Shale Development Program A-42

Captain Howard N. Moore, USN, Director Naval Petroleum and Oil Shale Reserves A-64

John S. Kelly, Director, Division of Peaceful Nuclear Explosives, AEC A-66

Joseph L. Fisher, Resources for the Future Inc., and Chairman of the Oil Shale Advisory Board to the Secretary of the Interior A-69

R. T. Eckles, Coordinator, Division of Natural Resources, State of Colorado A-72

Captain Albert Stanley Miller, USN Ret. former Director, Naval Petroleum and Oil Shale Reserves A-74

Franklin Wallick, Washington Representative, UAW of the AFL-CIO A-76

TABLE OF CONTENTS (CONT.)

Page

James H. Smith, Jr., Wolf Ridge Minerals Corp. A-78

Honorable Wallace F. Bennett, Senator from Utah A-87

Extract from the 1966 Annual Report of the Office of Coal Research A-89

Oil Shale Ownership Map Inside back cover

HIGHLIGHTS OF THIS REPORT

The Federal 5-Point Oil Shale Development Program
(Page 1)

A discussion of the Federal 5-Point Oil Shale Development Program, announced by Interior Secretary Udall on January 27, is presented as a special feature of this report. The newly-announced program represents a major change in stance by Interior concerning oil shale development. Private enterprise, seemingly, is to be given a chance at development of Federally-owned oil shale, through a program that ensures co-development of deposits of soda and alumina minerals which occur within the oil shale formations. Two-stage development contracts are to be required, the first stage involving commercialization of allocated acreages. Firm conditions and regulations pertaining to the program are not expected for several months.

Senate Holds Hearings on the Federal 5-Point Program
(Page 9)

Senate Hearings on the Federal 5-Point Program were held on February 21 and 22 before the Interior and Insular Affairs Committee. Ten spokesmen were heard, representing Government, industry and other groups. Reproductions of each presentation are presented in the Appendix of this report.

Secretary Udall's presentation disclosed that he is seeking means for clearing land titles and that he is trying to "sell" to Congress a recording statute. Udall stated that our Nation's present reserves of conventional petroleum can carry us through this century at no cost increase, and that a 50,000 barrel/day shale oil operation would require only 950 acre feet of water per year. Both are rather surprising statements.

Details of Federal Oil Shale Test Program Disclosed

(Page 10)

Interior Secretary Udall distributed copies of the "Federal Oil Shale Resource Development Program" at the time of his appearance before the Senate Interior and Insular Affairs Committee. The program is a 10-year, $101 million project, and a reproduction of the program is presented in the Appendix section of this report.

Events Relating to Oil Shale Land Reviewed

President Hoover's "temporary" oil shale withdrawal order of 1930 was tested in the U. S. Court of Appeals in Denver and was found to be still in effect. (Page 1-1)

In the U. S. District Court in Denver, the Court ruled against the Department of the Interior by stating that failure to perform annual assessment work on pre-1920 oil shale mining claims does not give Government possessary right to the claims. (Page 1-2)

An up-dated version of our Colorado oil shale ownership map is presented as the last page of this report.

The status of the studies by the Public Land Law Review Commission is examined, and the present membership of the Commission is presented, beginning on page 1-6.

Oil Shale Technology

The nuclear in-situ experiment, proposed by CER Geonuclear Corporation, has generated wide interest and attention from industry and from Government. The consortium of interested companies, which now numbers 25, held a project review meeting in Dallas during January. Feasibility studies, time scheduling, economic factors and anticipated problems are discussed beginning on page 1-10.

Oil Shale Technology (continued)

The effect of anticipated problems on the economics of the nuclear in-situ process are discussed, beginning on page 1-16.

The Institute of Gas Technology (IGT) published a comprehensive final report on its 5-year study of the gasification of oil shale. A review of the IGT report is presented, beginning on page 1-23.

TOSCO Discloses Company Data in SEC Document
(Page 1-29)

The Oil Shale Corporation (TOSCO) is offering to sell additional stock under a plan by which Aquitaine Oil and Auxirap Corporation each may acquire up to 35.44% ownership of TOSCO. The data disclosed in the stock-offer prospectus filed with the Securities and Exchange Commission concern land-purchase agreements, agreements for commercial shale oil plants, possible means for transporting and for marketing shale oil, etc., and these data are reviewed.

Water Supplies for Oil Shale -- A Look at Proposed Facilities (Page 1-48)

Public records of the Colorado State Engineer's office were reviewed to provide data concerning the physical facilities proposed by companies interested in developing water supplies for use in future oil shale operations. The various facilities proposed by water-right claimants are described.

The hydrology of the Piceance Basin area is of current interest. Preliminary studies conducted at the Bureau of Mines "Colorado Corehole No. 1" are presented, beginning on page 1-48.

Legislation Would Clarify O&G/Tar Sands Rights in Utah (Page 2-1)

Senate Bill S.B.77, now before the Utah Senate, would provide a single hydrocarbon lease for State-owned lands in Utah. The provisions of the Bill are reviewed and a reproduction of the Bill is provided in the Appendix section.

Land and water holdings of the Bituminous Sands Corporation of America are reviewed, beginning on page 2-2.

Slurry Pipeline to Transport Coal to Nevada (Page 3-1)

The largest and longest coal-slurry pipeline will be built across Arizona into Nevada. It will carry coal from the Navajo and Hopi Indian reservations across semi-desert country where there are no direct railroad connections. It will move 12,000 tons of coal per day by 1971.

Island Creek Coal Company may Merge with Iron-Mining Company (Page 3-4)

Island Creek Coal Company became the latest in a series of potential mergers. Its directors and the directors of Cleveland Cliffs Iron Company have agreed to make studies on a proposed merger.

Office of Coal Research Developments are Reviewed (Pages 3-5 to 3-10 and in the Appendix, Page A-89)

The status of OCR projects is reviewed and the recent reports noted. In the appendix, the new pilot plant for Project "Gasoline" is described and pictured.

Western Coal Developments (Pages 3-11 to 3-23)

The details of coal developments in the western states are presented. Colorado has been singled out for a deeper study of coal events.

COMING EVENTS CONCERNING
OIL SHALE AND RELATED FUELS

Date	Event
March 9-10	Symposia on: Factors Affecting Future Availability of Oil and Gas; and Prospects for Coal, Oil Shale and Tar Sands as Commercial Sources of Liquid Hydrocarbons. Sponsored by U. S. Department of Interior, Office of Oil and Gas, Washington, D. C. Tentative program includes: Reichl, Eric (Consolidation Coal Co.) Outlook for Oil and Gas Made from Coal Koolsbergen, H. I. (Oil Shale Corporation) Oil and Gas from Shale Ball, Douglas (Ball Associates) Oil and Gas from Tar Sands
March 8-10	7th Annual Institute on Exploration and Economics of the Petroleum Industry, Karcher Auditorium, Storey Hall, Southern Methodist University, Dallas, Texas. Program includes: Cameron, Russell J., Oil Shale, A Supplement Not a Substitute, For Tomorrow's Oil--The Status of Oil Shale Problems
March 14-15	Fly Ash Utilization Symposium, Hilton Hotel, Pittsburgh, Pa.
March 29-31	Symposium on the Science and Technology of Coal, Ottawa, Canada.

April 2-8	7th World Petroleum Congress, Mexico City, Mexico. World Petroleum Congresses are held every four years. At this 7th Congress, according to a tentative program prepared by the Mexican Organizing Committee, there will be presented two panel discussions of special interest. These are: Panel Discussion No. 13: "Occurrence and Prospects of Tar Sands". General topics tentatively scheduled for discussion include the tar sand deposits, the chemical and physical nature of tar sands, technical problems of mining and processing tar sands, and *in situ* methods for recovery of bitumen from tar sands. Panel Discussion No. 14: "Occurrence and Prospects of Oil Shales". General topics tentatively scheduled for discussion include the oil shale occurrences and prospects, geologic settings, constitutional aspects of kerogen, synthesis of oil shale, precursors of oil shale, associated saline minerals, yield predictions from log analysis and brief summaries concerning oil shales in Brazil and Thailand.
April 6-7	4th Annual Oil Shale Symposium. Sponsored jointly by the Colorado School of Mines, the C.S.M. Research Foundation and the American Institute of Mining, Metallurgical and Petroleum Engineers, Brown Palace Hotel, Denver, Colorado. Program includes: Donnell, J. R. (U. S. Geological Survey), *Alaska Oil Shale*

Melton, N. M. (U. S. Bureau of Mines), Fracturing Oil Shale with Electricity.

Miller, J. D. and Howell, J. F. (U. S. Bureau of Mines), Liquid Explosive Fracturing of Oil Shale Formations.

Schlinger, W. G. and Jesse, D. R. (Texaco, Inc.), Hydroretorting of Oil Shale.

Dyni, J. R. and Hite, R. J. (U. S. Geological Survey), Distribution of Dawsonite and Nahcolite in the Piceance Basin.

Eckles, R. T. (State of Colorado, Natural Resources Coordinator), Status Report on Oil Shale and Dawsonite.

A special chartered flight of from 2 to 2-1/2 hours' duration will cover the oil shale areas, leaving Denver in the P.M. of April 7.

April 9-14	153rd National Meeting, American Chemical Society, Miami Beach, Florida.
April 10-12	13th Annual Meeting, Institute of Environmental Sciences, Shoram Hotel, Washington, D. C.
April 24-26	National Congress on Environmental Health Management, conducted by the American Medical Association, Hotel Americana, New York, N. Y.
April 25-27	American Power Conference, Sherman House, Chicago, Ill.
April 27-28	Symposium on the Technology and Use of Lignite, University of North Dakota, Grand Forks, N. D.

May 15-18	Coal Show, American Mining Congress, Cleveland, Ohio.
May 21-24	62nd National Meeting, American Institute of Chemical Engineers, Hotel Utah, Salt Lake City, Utah. Program not prepared. Two sessions on "Hydrocarbons, Minerals and Natural Resources" are contemplated. Program chairman: L. B. Lyon of American Hydrocarbon Company, Salt Lake City.
May 21-30	International Water for Peace Conference, called by President Johnson and about 120 nations to be represented, Washington, D. C.
June 12-14	Midyear Meeting, Interstate Oil Compact Commission, Cosmopolitan Hotel, Denver, Colorado. Program not available.
June 19-23	8th Carbon Conference, University of Buffalo, Buffalo, N. Y.
June 20	Bureau of Land Management Hearings, Colorado Contests 359 and 360, 10:00 A.M., Room 162, U. S. Court House, Denver, Colorado. Concerns administrative action by Interior to reject "typical" unpatented oil shale claims.
June 25-28	Rocky Mountain Coal Mining Institute, Annual Convention, Stanley Hotel, Estes Park, Colorado. Program not available.
July 3-7	Gordon Research Conference on Coal, New Hampton School, New Hampton, New Hampshire.

Sept. 10-15	154th National Meeting, American Chemical Society, Division of Fuel Chemistry. Chicago, Illinois. Program to include a "Symposium on Oil Shale and Shale Oil."

RECENT PUBLICATIONS OF INTEREST

Oil Shale:

Energy R&D and National Progress, Report of Energy Study Group, to the Interdepartmental Study Group for Submittal to Office of Science and Technology, Executive Office of the President, November 1966.

Watkins, J. Wade, (Director of Petroleum Research, U.S.B.M.), Informal Report on Production of Oil From Oil Shale, Interstate Oil Compact Commission, Annual Meeting, Phoenix, Arizona, Dec. 12-14, 1966.

Hibbard, W. R., Jr., (Director, U. S. Bureau of Mines), A Look Ahead at Synthetic Hydrocarbon Technology, American Institute of Mining, Metallurgical and Petroleum Engineers, 96th Annual Meeting, Los Angeles, California, February 1967.

Lesser, H. A., et al, Conduction Heating of (Oil Shale) Formations with Limited Permeability by Condensing Gases, Society of Petroleum Engineers Jounral, December 1966.

Linden, H. R., Feldman, F. F., et al, Production of Pipeline Gas by Hydrogasification of Oil Shale, Research Bulletin Number 36, Institute of Gas Technology, 1966.

Jacobsen, I. A., Thermal Reactions of Shale Oil Components: Methylpyrroles, Butypyrroles, U. S. Bureau of Mines, Report of Investigations #6720, 1966.

Shale Oil is Still Many Years Away, Editorial, Oil and Gas Journal, February 6, 1967.

U. S. Will Open Oil-Shale Door Slowly, Oil and Gas Journal, February 6, 1967.

Barry, Frank J., (Solicitor, Department of Interior), Plans for Oil Shale Development, 70th National Western Mining Conference, Denver, Colorado, February 10, 1967.

Walker, Roscoe, A Look at Oil Shale by a Practicing Attorney, Southwestern Institute of Oil and Gas Law and Taxation, 18th Annual Meeting, Dallas, Texas, February 9, 1967.

Tar Sands:

Doscher, T. M., (Shell Oil Company), Technical Problems in In Situ Methods for Recovery of Bitumen from Tar Sands, 7th World Petroleum Congress, Mexico City, Mexico, April 2-8, 1967.

Carrigy, M. A. (Research Council of Alberta), The Physical and Chemical Nature of a Typical Tar Sand, Bulk Properties and Behaviour, 7th World Petroleum Congress, Mexico City, Mexico, April 2-8, 1967.

Gold, Otto, Technical Problems in the Mining of Tar Sands, 7th World Petroleum Congress, Mexico City, Mexico, April 2-8, 1967.

Dor, A. A., Daly, W. J., Floyd, P. H., and Hall, F.T., (Bechtel Corporation), Technical Problems in the Processing of Mined Sand for Oil Recovery, 7th World Petroleum Congress, Mexico City, Mexico, April 2-8, 1967.

Bowman, C. W., (Syncrude Canada, Ltd.), Molecular and Interfacial Properties of Athabasca Tar Sands, 7th World Petroleum Congress, Mexico City, Mexico, April 2-8, 1967.

Spragins, Frank K., (Syncrude Canada, Ltd.), Athabasca Tar Sands Project, A.I.M.E., 96th Annual Meeting, Los Angeles, February 19-23, 1967.

Coal:

Papers given at the American Gas Association Symposium, Pittsubrgh, Pa., November 15, 1966. (Abstracts appear in Coal Age, Dec. 66, pp 120-122)

Shora, F., Status of OCR-AGA Project. (Hydrogasification of coal)

Hiteshue, R. W., The Hydrogasification of Raw Bituminous Coal.

Benson, H. E., Steam-Iron Process. (Hydrogen from coal without using oxygen.)

Phinney, J. A., The CO_2-Acceptor Process - A Status Report. (pipeline gas from lignite).

Tsaros, C. L., Economics of Pipeline Gas Via Hydrogasification. (of coal).

Fumich, George, Jr., OCR Plans for Development of Synthetic Pipeline Gas. (Off the cuff, he added that he expected greater funding for the Office of Coal Research for Fiscal 1968).

Glenn, R. A., Progress in the Development of Synthetic Pipeline Gas. (from coal.)

Field, J. H., et al., High-Btu Gas Via Fluid-Bed Gasification of Caking Coal and Catalytic Methanization.

Skaperdas, G. T., The Kellogg Coal-Gasification Process.

Farr, Walter, Coal Carbonization...New Methods and Objectives, Coal Age, Dec 1966, pp 88-96.

Selected papers from "Pollution" edition of Chemical Engineering Progress V.62, No. 10, Oct. 1966:

Zimmerman, R. E., Economics of Coal Desulfurization.

Katell, S., Removing Sulfur Dioxide from Flue Gases.

Squires, A. M., Top Heat Cycle for Clean Power.

Jimeson, R., Utilizing Solvent Refined Coal in Power Plants. (This refers to de-ashed coal).

Anon., Coal Research, published by Bituminous Coal Research, Inc., No. 25 Winter, 1966.

Bureau of Mines Publications:

Warfield, Robert S., et al, Sampling and Coking Studies of Coal from the Kukpowruk River Area, Arctic Northwestern Alaska, Report of Investigations, RI 6767, 1966.

Zeilinger, J. E., et al, A Coal-Fired Water Pump, Report of Investigations, RI 6858, 1966.

Karr, Clarence Jr., et al, Influence of Continuous Carbonization Method, Temperature, and Carrier Gas on the Amounts of Individual Pyrolysis Products from a Subbituminous Coal, Report of Investigations 6839, 1966.

Kawa, Walter, et al, Reaction of Coal in Argon and Argon-Hydrogen Plasmas, Report of Investigations 6829, 1966.

Sharkey, A. G., Jr., et al., Comparison of Products from High-Temperature Irradiation and Carbonization of Coal, Report of Investigations 6868, 1966.

Koch, George S., Jr., et al, Delineation of Texas Lignite Beds by Statistical Techniques, Report of Investigations, RI 6833, 1966.

United States Geological Survey Publications:

Averitt, Paul, Coking-Coal Deposits of the Western United States, Bulletin 1222-G, 1966.

Collier, E. L., et al, Electrogasdynamics and Precipitation, Industrial and Engineering Chemistry, Dec. 1966, pp 26-29.

Papers presented at the AIME 96th Annual Meeting in Los Angeles, Feb. 19 to 23, 1967.

Winger, John G., Outlook for the Domestic Energy Market for the Next Decade, paper No. SPE 1527.

Anderson, Robert O., Hydrocarbons and 1980, paper No. SPE 1741.

Hibbard, Walter R., Jr., A Look Ahead at Synthetic Hydrocarbon Technology, paper No. SPE 1742.

Spragins, Frank K., Athabasca Tar Sands Project, paper No. SPE 1743.

Cochran, Neal P., Production of Useful Hydrocarbons from Coal, paper No. SPE 1744.

Dwyer, Cornelius J., The Future Course of Competition Among Energy Resources for the Electric Power Market.

Dunn, Cecil L., Competitive Energy Sources in the Pacific States.

Lucas, J. R., Coal in the Eastern United States Energy Market.

Jensen, J. T., Role of Liquefied Natural Gas in United States Gas Supply.

Reports Issued from the Office of Coal Research:

Jackson and Moreland Div., United Engineers and Constructors, Inc., Review and Evaluation of Project Fuel Cell. (Reviewed on page 3-7 of this report).

Robert R. Nathan, Inc., The Potential Market for Midwestern and Alaskan Coal and Lignite. (Reviewed on page 3-9 of this report).

FMC Corp., Supplemental Report on Char Oil Energy Development. (See page 3-10 of this report).

Water:

Water and Land Resources - White River Basin in Colorado, Colorado Water Conservation Board and the U. S. Department of Agriculture.

General Interest:

Tarry, P. D., Evaluation of United States Oil Resources as of January 1, 1966, Interstate Oil Compact Commission, Phoenix Arizona, December 12, 1966.

Hibbard, Walter R., A Look Ahead at Synthetic Hydrocarbon Technology, 96th Annual Meeting, A.I.M.E., Los Angeles, February 16-19, 1967.

Anderson, Robert O., (Atlantic Richfield), Hydrocarbons and 1980, 96th Annual Meeting, Los Angeles, February 16-19, 1967.

Special Feature

Special Feature

THE FEDERAL FIVE-POINT OIL SHALE DEVELOPMENT PROGRAM

Secretary Udall Announces Federal Oil Shale Program

Secretary of Interior Stewart Udall announced, on January 27, 1967, a five-point Federal program to promote recovery of shale oil and associated minerals from the Green River oil shale formation.

For reference purposes, Secretary Udall's announcement is reproduced and is presented beginning on page A-11 of the Appendix section of this report.

In summary form, the five-point program involves:

1. Action to clear title to public oil shale lands.
2. A possibility of "blocking up" of reserves through a program for exchange of scattered parcels of private land for similar quality Federal land.
3. Provisional "developmental" leases of Federal lands followed by "commercial" leases if the research and developmental project is successful.
4. Cooperative effort by the Atomic-Energy Commission and by private capital to develop a nuclear *in situ* method for recovering shale oil from oil shale
5. Provision for a greatly increased program of research and development by the U. S. Geological Survey, the U. S. Bureau of Mines and the U. S. Bureau of Land Management.

This announcement represents the advent of a new policy by the Department of Interior for Federal oil shale lands. While there are many conditions yet to be clarified concerning the program, the general reaction of Congressman, state officials and of industry seems to be that some meaningful oil shale developments may now be possible.

Each point of the Federal five-point program will be discussed.

Point 1, Action to Clear Title to Public Oil Shale Lands.

Point 1 involves action to clear title to public oil shale bearing lands of Colorado, Utah and Wyoming approximately 7,000,000 acres of public land are affected. This action involves the withdrawal of oil shale lands from all mineral entry (other than oil and gas) and the initiation of examinations and contests to remove clouds on land title.

Efforts to clear title to public oil shale lands actually began in earnest three years ago when, on April 17, 1964, Interior Solicitor Frank J. Barry issued a legal opinion which triggered administrative rejections of patent applications for 257 "typical" unpatented oil shale placer mining claims. On the basis of Solicitor Barry's legal opinion, Secretary Udall instructed the Director of the Bureau of Land Management to identify and determine the ownership status of all unpatented oil shale placer mining claims.

Concerning the withdrawal of oil shale lands from all mineral entry, other than for oil and gas leases, action has already been taken. On January 26, 1967, Boyd Rasmussen, Director of the Bureau of Land Management made formal application for "withdrawal of all deposits of oil shale and all lands containing such deposits in Colorado, Utah and Wyoming which are owned by the United States", pursuant to the regulations in 43 CFR, Subpart 2311. Rasmussen's application for withdrawal is reproduced and is presented beginning on page A-17 of the Appendix section of this report. The Federal Register of January 28 carried a brief notice of the application, which is reproduced on page A-22 of the Appendix section of this report. The application states that the lands would be withdrawn from appropriation under the mining laws insofar as they apply to metalliferous minerals and would also be withdrawn from sodium leasing except where development of sodium deposits would not adversely affect, in any significant way, the oil shale values of the lands.

The initiation of examinations and contests to clear title to public lands can be expected to be an expensive and time-consuming task. The April 17, 1964 rejection of 257 "typical" mining claims (there are, reportedly, some 30,000 pre-1920 unpatented oil shale placer mining claims) immediately triggered administrative contests within the Bureau of Land Management, such as BLM hearings on objections to the rejections, and resulted also in the initiation of legal contests such as civil action cases before the United States District Court in Colorado. The first of these BLM contests, namely Colorado Contests 359 and 360, are still in progress. On February 3, 1967 the Bureau of Land Management posted a "Notice of Hearing" which states that the next scheduled hearing in these contests would be held on June 20, 1967 commencing at 10:00 AM in Room 162 of the U. S. Court House, 1929 Stout Street, Denver, Colorado. The first of the civil action cases resulting from the April 17, 1964 rejection of unpatented claims was just recently ruled upon (on December 21, 1966) by Judge William Doyle of the U. S. District Court in Denver. Judge Doyle's decision was adverse to the Department of Interior, and Secretary Udall has stated publicly that the adverse decision will be appealed.

Note: Judge Doyle's decision in combined Civil Action Cases 5680, 8685, 8691 and 9202 is discussed in detail in the "Oil Shale - Land" section of this report. A copy of Doyle's decision is reproduced and is presented beginning on page A-1 of the Appendix section of this report.

Point 1, Action to Clear Title to Public Oil Shale Lands (Continued)

In order to clear title of lands on which mining claims have been filed recently, presumably, to obtain title to the aluminum content of dawsonite ($Na_3Al(CO_3)_3 \cdot 2\ Al(OH)_3$), we anticipate that Interior will simply reject such claims, this includes some 1700 claims on oil shale lands to the north of the Piceance Basin presumed to contain platinum. Both platinum and aluminum were thought to be "locatable" metals under the mining laws. However, on lands containing oil shale deposits, the situation is not so simple. Public Law 585 (68 STAT 708) of the 83rd Congress specified that such claims on known oil shale lands carry no rights to oil shale itself. Oil shale and dawsonite being intimately intermixed, complicate the ownership situation, especially in light of the Point 1 requirement that sodium mineral development must not adversely affect the oil shale values. A simple declaration by Interior stating that dawsonite is a leasable rather than a locatable mineral would automatically nullify these recent mining claims filed (presumably) for rights to dawsonite. To our knowledge, such a declaration has not yet been made.

Removal of title clouds on public oil shale lands must involve some disposition of the applications for sodium prospecting permits, the prospecting permits that have been granted, and the applications for preference right sodium leases that are on file. Currently, there are eight applications for preference right leases covering approximately 20,000 acres. There are 84 pending applications for sodium prospecting permits in Colorado and Utah. As a means of preventing further clouding of land titles, John Crow, Associate Director of the Bureau of Land Management issued a Memorandum dated December 21, 1966, in which State BLM Directors were reminded that sodium leases and prospecting permits in oil shale areas should not be issued without the prior approval of Crow's office. Crow's Memorandum of December 21, 1966 and a transmittal letter of explanation are reproduced and presented on pages A-20 and A-21 of the Appendix section of this report.

Point 1, Action to Clear Title to Public Oil Shale Lands (Continued)

Secretary Udall stated at his January 27, 1968 Press Conference, "On Item Number 1, clearing title, the legal problems, we, of course, are already in action. We hope to step up our action, provide additional assistance to the Bureau of Land Management, additional personnel to gather facts and to contest claims".

Point 2, The "Blocking-up Program" for Consolidation of Private Land Holdings

As Point 2 of the 5-point Federal oil shale development program, Secretary Udall will give consideration to applications for the exchange of scattered oil shale lands owned in fee for Federal lands of similar quality. For applications to be considered, the applicant would first be required to agree to a time schedule and to investment commitments for the "development of economic mining and recovery operations".

The blocking-up program was not discussed by Secretary Udall at his January 27 news conference. It would seem apparent that a great deal of work would be necessary before properties could be evaluated and adjudged to be of "similar quality". It would also seem apparent that title problems on Government lands would have to be resolved prior to exchanges of property.

Point 3, The Provisional Developmental Leases and the Commercial Development Leases

As Point 3 of the Federal program, the Secretary will permit consideration of applications for "provisional developmental leases" of Federal oil shale lands. Procedures are yet to be announced, but Interior will contract for a variety of approaches to the development of economic processes for the recovery of oil and associated minerals from oil shale. Applicants will be required to describe the process sought to be developed, to make a commitment of research and development expenditures, agree to a time schedule, and determine the approximate volume and location of oil shale and associated minerals required to support operation of a commercial plant. In his news conference, Udall stated, "We think the proper way to regulate this, the precise way, rather than giving someone so many acres, is to set up a program that would be sound economically and could be amortized for 30 years, 50 years; and that they would receive that quantity of the resource that was necessary to carry out the program contemplated by their investment". Udall was then asked if that would be changing the Mineral Leasing Act. He replied, ".. Yes, indeed. Because our present leasing laws may not be flexible enough or versatile enough".

Leases for larger tracts for commercial development will not be issued until the research and development contract has been successfully performed. Other requirements for a commercial lease will be an assurance that a commercial plant will be built and that certain conservation practices be observed.

Point 4, The Federal/Private Researching of the Nuclear In-Situ Process

Point 4, the program that would enlist the Atomic Energy Commission and private capital with Interior to research the nuclear in-situ process apparently refers to the CER Geonuclear Corporation proposal which currently involves 25 companies. At his press conference, Udall mentioned Point 4 by stating, "We're working with the Atomic Energy Commission on 4, and on our own part. We expect to step up the present effort that is being made and hopefully to have at the right time whenever the scientists are ready--feel we are ready and have the right locations to try out underground atomic explosions". Concerning timing of this experiment, Udall stated, "They are somewhat more optimistic than some of my people are with regard to the timing factor...".

Point 5, The Broad Program of Federal Research

As Point 5 of the Federal program, Interior will request funds for a broad program of Federal research. The program will involve the Geological Survey, the Bureau of Mines, and the Bureau of Land Management. Close cooperation with industry and with public and private research facilities will be required, according to Secretary Udall. "We are suggesting in 5", Udall stated at the January 27 press conference, "that we are going to do more research". The figure $100 million to be spent by the Government on oil shale research in the next ten years is attributed to news conference of January 27 by various news media, but a review of a transcript of this conference fails to verify the statement or the figure.

Timetable of Events Related to the Federal 5-Point Program

	Name of Event	Date or Estimated Date
1.	Announcement by Secy. Udall of the Federal 5-Point Development Program	January 27, 1967
2.	Hearings by Interior on Federal 5-Point Program	No Interior hearings contemplated.
3.	Proposed Rules and Reg-Regulations for Federal 5-Point Program	60 to 90 days from January 27, 1967
4.	Senate Hearings on Federal 5-Point Program, Interior and Insular Affairs Committee	February 21, 1967 (Reported under separate heading)
5.	Senate Antitrust Committee Hearings on Federal 5-Point Program	To follow hearings by Interior and Insular Affairs Committee. Date not set.
6.	Regulations and Conditions, Federal 5-Point Program	5 months. (See Barry's presentation reproduced on pg A-30 of Appendix)
7.	Federal Test Program	Published (1968 thru 1977) See pg. A-42 for reproduction.

Solicitor Barry Discusses, "Mining Claims and an Oil Shale Program: The Government's Search for Industry Understanding"

Frank J. Barry, Solicitor, Department of the Interior, presented Mining Claims and an Oil Shale Program: The Government's Search for Industry Understanding, at the 70th Annual National Western Mining Conference in Denver, Colorado, on February 11, 1967.

Barry, as Interior Solicitor was author of the April 17, 1964 decision which triggered the administrative rejection of "typical" unpatented mining claims.

Barry noted that title to about 400,000 acres of oil shale lands are clouded by about 30,000 unpatented claims located prior to 1920. Also, some 3500 new claims presumably for dawsonite values, now cover 500,000 additional acres in Colorado and 1740 new claims cover 250,000 acres in Utah. About 1700 claims, presumably for platinum, now cover 250,000 acres in Moffatt County, Colorado.

Barry noted that the due process clauses in our Constitution require legal resolution of contested title problems, and that this will result in a sizeable task by the time 40,000 mining claim contests are resolved. To eliminate invalid claims, each claim must be examined on the ground, contest proceedings initiated, contestants identified, hearings held, appeals considered, and finally, the administrative decisions may be challenged in the courts.

With regard to Point 1 of the Federal program, Interior will be called upon to perform the functions of dispassionate adjudication and resource promotion.

Barry noted that a full five months will be required before the Government regulations can be announced concerning the 5-Point Program.

Solicitor Barry Discusses "Mining Claims and an Oil Shale Program: The Government's Search for Industry Understanding" (Continued)

An approach similar to that now underway involving oil shale claims will also be used to determine the validity of recent claim locations for dawsonite and other minerals. Specific claims which will adequately raise all relevant issues will be selected and contested. Any departmental decisions would then operate as a precedent to determine the validity of the bulk of the remaining claims.

Not contained in the transcript of his presentation were statements by Barry that provisional leasing may require legislation, that there has been some serious thinking about a big open-pit mining operation, and that the discovery of sodium minerals in oil shale triggered action in Interior's planning for an oil shale program.

Barry's paper is reproduced and is presented beginning on page A-27 of the Appendix section of this report.

Senate Holds Hearings on Federal Oil Shale Program

The Senate Interior and Insular Affairs Committee held public hearings on February 21 and 22 on the Federal Oil Shale Development Program. Statements by ten spokesmen from Government and industry were heard.

In the Appendix section of this report we present copies of the statements presented before the Committee The statements appear beginning on page A-35. In addition, we are presenting a copy of the "Oil Shale Resource Development Program" which was distributed at the Senate Hearings during the presentation by Interior Secretary Udall. This document is presented beginning on page A-42 of the Appendix. It presents details of the 10-year program, proposed by Interior, to cost a total of $101 million. Your attention is invited to page A-45 of the Appendix for a tabulation of the yearly costs of the various portions of the proposed program, through the year 1977.

Abstracts of each of the statements in the order that they were made before the Committee, are presented in the following paragraphs.*

1. Interior Secretary Stewart Udall presented testimony which essentially reiterated the basic purposes of the 5-point program. He did, however, make some dramatic statements regarding known reserves and industry water requirements. The Secretary indicated that his information shows known oil reserves to be adequate for the remainder of this century and that only 20,000 acre feet of water per year would be required for a million barrel a day installation. Udall's presentation is reproduced, beginning on page A-35 of the Appendix section.

2. Captain Howard N. Moore, USN, the Director of the Naval Petroleum and Oil Shale Reserves related the U. S. Navy's reaction to Interior's 5-point program and generally endorsed each point. Capt. Moore, however, did indicate that the Navy considers that the nation is becoming crude deficient. He further emphasized that from the stand point of national defense oil shale reserves are of questionable value in themselves without a viable industry. Captain Moore's presentation is reproduced, beginning on page A-64 of the Appendix section.

3. John S. Kelly reviewed the concept of utilizing nuclear explosives to create an underground rubble-filled chimney within oil shale formations. While there was nothing particularly new in his presentation, he did state that experience to date with many underground nuclear explosions indicates that the size of rock created by the nuclear explosion

---

*A statement by Angus MacDonald, Director of Research, National Farmers' Union, was not available in time to include in this report.

would be amenable to an in-place retorting process such as that required for oil shale. Kelly's presentation is reproduced, beginning on page A-66 of the Appendix section.

4. Joseph L. Fisher, Chairman of the Oil Shale Advisory Board to the Secretary of Interior, heartily endorsed the 5-point program with emphasis, however, on expeditious action to establish royalties, depletion allowance, taxation and commercial type lease conditions. Fisher's presentation is reproduced, beginning on page A-69 of the Appendix section.

5. R. T. Eckles, Coordinator, Dept. of Natural Resources (Colo.) noted that much of the Federal 5-point Program is consistent with recommendations made three years ago by Colorado in response to the Secretary's request for suggestions looking toward formulation of a program. In Colorado, during these past three years, tens of millions of dollars have been spent in private research. Claimants have done all in their power to break the legal log jam affecting mining claim patent applications. Attention has been given to problems of financing the schools, roads and community services which must be provided.

   Some problems, water supply is an example, cannot be solved by thinking alone, but require implementation now if oil shale is to develop in a decade. The necessary time to solve this kind of problem is irretrievably escaping us day by day. Eckles' presentation is reproduced, beginning on page A-72 of the Appendix section.

   Note: In the absence of Mr. Eckles, the paper was read by R. J. Cameron. In response to questioning by Sen. Allott, Cameron stated, "As a personal observation, I am puzzled by the Secretary's reference

> to our present petroleum resources carrying us into the next century at no increase in cost". Cameron also stated that Federal authorities concerned with conservation and the prevention of air and water pollution should check with our State agencies to see what is being done in Colorado.

6. Captain Albert S. Miller, USN retired, a former Director of the Naval Petroleum and Oil Shale Reserves, presented his personal belief that the government participation in the development of an industry should be limited to providing tax or other incentives rather than outright financial assistance which would surely carry numerous regulations. Further, Captain Miller, questioned whether those companies who have already expended time and money in R&D should be forced to participate in the first step of the two-step leasing program. He asserted that such an inflexible program would essentially amount to a re-run for the pioneers and considers an inflexible two-step leasing program, a possible "soft spot" in the Secretary's overall program. Captain Miller's presentation is reproduced, beginning on page A-74 of the Appendix section.

7. Franklin Wallick, Legislative Representative, UAW, AFL-CIO, stated that Congress should move with caution in leasing public land for oil shale development, noting that the deposits may be worth $300 billion, 85 percent of which is on public land. He quoted John Kenneth Galbraith's "warning" contained in the final report of the Federal Oil Shale Advisory Board which stated, "The American people are not presently aware of the wealth they own in these deposits". Wallick then raised these several questions:

Senate Holds Hearings on Federal Oil Shale Program (Continued)

(1) It is unsound for 52-1/2% of all royalties to go for reclamation, 37-1/2% for the states and only 10% to the Federal government.

(2) Questions whether leasing of surface deposits is desirable.

(3) Government should have right to renegotiate any leases once a feasible claim is operating.

(4) Great caution should be taken not to damage watersheds and wildlife.

Wallick's paper is reproduced, beginning on page A-76 of the Appendix section.

8. James H. Smith, Jr., representing Wolf Ridge Minerals, presented testimony which went into considerable detail on his company's development work on dawsonite and nahcolite and indicated that further work is blocked until leases are issued by the Secretary of the Interior. Smith's presentation is reproduced, beginning on page A-78 of the Appendix section.

9. Senator Wallace F. Bennett, R-Utah, stated that he was generally pleased with the announcement of the Federal 5-point program, but he hoped that after 40 years of confusion and delay, Interior is not merely "beginning to study how to commence". Bennett listed three obstacles to early development of oil shale:

(1) Lack of a clear-cut and workable leasing regulation

(2) Uncertainty as to validity of mining claims.

(3) Delays and problems not related to bureaucratic red tape.

Bennett's presentation is reproduced, beginning on page A-87 of the Appendix section.

I

OIL SHALE

1930 WITHDRAWAL ORDER RECEIVES COURT TEST

President Hoover's temporary oil shale withdrawal order, Executive Order #4327 of April 15, 1930, was tested in the U. S. Court of Appeals, 10th Circuit, Denver, and was found to be still in effect. An appeal had been filed by Allan Mecham of Salt Lake City, following an adverse decision in Civil Action C-22-65 before the U. S. District Court for Utah in 1966. The Denver appellate court decision upholding Hoover's order contained this statement, "We cannot say that from the Government's viewpoint and considering its permanence compared to the life of man, and the significance of oil shale as a natural resource, that this has not been temporary".

ASSESSMENT WORK PERFORMANCE RULED UNNECESSARY TO RETAIN PLACER CLAIMS

On December 21, 1966, Judge William Doyle of the United States District Court in Denver issued a MEMORANDUM OPINION AND ORDER in four combined oil shale civil action cases* in which the issue of the necessity for performing annual assessment work is being tested.

Decision to Come Later

Judge Doyle's DECISION will be issued at a later date, but, from the views expressed in the MEMORANDUM OPINION AND ORDER, The DECISION will be against the Department of Interior and favorable to the various plaintiffs who are seeking to compel Interior to issue patents on unpatented oil shale placer mining claims. Interior had made administrative rejections of the

*	8680	TOSCO vs. Secy. of Interior
	8685	J. B. Umpleby vs. Secy. of Interior
	8691	B. T. Napier vs. Secy. of Interior
	9202	P. C. Brown vs. Secy. of Interior

plaintiffs' applications for patent. Interior's rejections all were based on Interior Solicitor Barry's April 17, 1964 opinion which stated that the Government had possesion rights to the unpatented claims due to plaintiffs' failure to perform annual assessment work and also due to the principle of res judicata.

Judge Doyle did not rule on the res judicata issue, stating merely that in these civil actions the principle does not apply because the adjudication (prior) by a tribunal lacking subject matter jurisdiction is wholly nugatory and cannot be res judicata.

Precedence Cited

Judge Doyle stated that a previous Supreme Court decision, Ickes vs. Virginia-Colorado Development Corporation, 295 U.S. 639, 55 S Ct. 888 (1935), clarified beyond question the proposition that the Government has never had a possessory right to pre-Leasing Act mining claims defective only for failure to perform assessment work.

Interior Appeal Expected

The plaintiffs were directed to submit forms of judgments reflecting views expressed in the OPINION, after first submitting them to defendant for approval as to form. Interior will have 60 days within which time it may file an appeal, the time to be counted from the date the decision is issued. As the final decision has not yet been entered, there is not yet anything to appeal. Secretary Udall has stated publicly that he will appeal this adverse decision.

Memorandum Order Appended

Judge Doyle included several interesting comments in his MEMORANDUM OPINION AND ORDER. Your attention is

ASSESSMENT WORK PERFORMANCE RULED UNNESESSARY TO RETAIN PLACER CLAIMS (Continued)

invited to a reproduction of this document which is presented in the Appendix section beginning on page A-1.

PENDING CIVIL ACTION CASES REVIEWED

A listing is presented on the page that follows, showing general information on all oil shale civil action cases still before the United States District Court and the United States Court of Appeals in Denver, Colorado.

The appeal on the Brennan vs. Secretary of Interior case, Docket Number 8722, is the only case for which a firm date has been set for hearing.

WYOMING COMMISSIONER OF PUBLIC LANDS DISCUSSES STATE POLICY

A. E. King, Wyoming State Commissioner of Public Lands, was asked if the recently-announced Federal program for oil shale development might result in changes of State policy toward development of State-owned oil shale land. Wyoming does not now lease any of its oil shale lands.

King indicated that his office is studying the Secretary's announcement; he further stated, however, that he intends to recommend a continuation of the present withdrawal policy to the State Board of Land Commissioners. The only action which would cause the Commissioner to recommend otherwise would be a Federal contract for research and development expenditures, granted for an area of Wyoming including State lands. In the event of such a contract, he stated, consideration would be given to releasing those lands included. King feels that since the State lands are so scattered, generally sections 16 and 36, any development project approved for State lands must be one which is undertaken in conjunction with a Federal program awarded by the Department of Interior.

OIL SHALE ACTION CASES
PENDING ACTION

Civil Action Number	Names of Plaintiff/Defendant	Issues Involved and Status
BEFORE THE UNITED STATES DISTRICT COURT IN DENVER:		
8156	J. B. Umpleby/Sec'y Interior	Plaintiffs contesting Interior's Administrative rejection of application for patent on oil shale mining claims. Court is asked to order that Interior issue patents. Trial date not set.
9252	H. H. Hugg/Sec'y Interior	Plaintiffs are contesting the April 17, 1964 Administrative rejection of applications for patent on unpatented claims Ready for trial, no date set.
9406	Pacific Oil/Sec'y Interior	Same as above Status: Same as above.
9458	J. Savage/Sec'y Interior	Same as above. Status: No action since June '66. Motion to stay discovery.
9461	Union Oil/Sec'y Interior	Same as above. Status: Ready for pretrial.
9464	Gabbs Exploration/Sec'y Interior	Same as above. Status: Ready for trial.
9465	TOSCO/Sec'y Interior	Same as Above. Status: Same as above
BEFORE THE UNITED STATES COURT OF APPEALS, TENTH CIRCUIT, DENVER:		
Docket Number		
8722	C. W. Brennan/Sec'y Interior	Plaintiff is appealing an adverse decision by U. S. District Court Judge Wm. Doyle in Civil Action #8542. Issues concern rights to oil shale values on certain pre-1914 homesteads. The appeal will be heard on March 22, 1967.

BUMINES OFFICIAL PREDICTS INDUSTRY WITHIN TEN YEARS

J. Wade Watkins, Director of Petroleum Research for the USBM, made this prediction at the December 12 meeting of the Interstate Oil Compact Commission in Phoenix, Arizona, "Within the Bureau of Mines we believe there may be an oil shale industry within 10 years. We have been criticized by some who say that 10 years is too long. Others say it is too optimistic. But it still appears to us to be a reasonable estimate".

In his presentation before the I.O.C.C., Watkins reviewed the status and problems in each of the major oil shale activity areas, areas which he classified as surface and in-situ research, characterization studies, and Government policy.

Watkins listed the TOSCO, Gas Combustion, Petrosix and Union retorts as the conventional retorts which offer commercial possibilities. He was very positive in stating that the mining-retorting concept is sound, and that his predicted commercial production of shale oil within ten years would be by this method.

In-situ retorting was suggested as the ideal approach, however, offering possibly reduced costs and lesser problems relating to pollution and avoidance of the spent shale disposal problem. Watkins noted the difficult problem concerning how to retort the shale once the "rubble-filled cavity" has been created by a nuclear detonation. He proposed a tentative plan for a preliminary retorting test, utilizing an excavation filled with random-size oil shale fragments. Such a test would more-nearly simulate retorting of the rock rubble than do the retorting tests now underway in the small-diameter retort used for simulation tests at the Laramie station of the Bureau of Mines.

PLLRC DIRECTOR DISCUSSES DEMAND FOR ENERGY FUELS

In a presentation entitled, Is There a Need for Expanded Oil Production?, given before the Interstate Oil Compact Commission meeting in Phoenix on December 12, 1966, director Milton Pearl emphasized his belief that a study of the demand for energy fuels is an absolute necessity.

Digressing from the printed text of his paper, Pearl disclosed that he has recently sent out to the various commissioners and representatives on the Public Land Law Review Commission (PLLRC) for their comments a proposed study plan. Their comments, when received, will be studied by his staff and a revised study plan will be made ready for contracting to an outside agency sometime in the late spring or early summer. Pearl gave the impression that the PLLRC will completely ignore any sort of time schedule as it goes into each aspect of public lands in minute detail. He also gave the impression that very little progress has been made to date. It seems apparent that there is very little possibility that the PLLRC can give any detailed guidance to the Congress in the near future.

Now returning to a review of Pearl's formal presentation, Pearl stated that in the growing conflict over uses of our available land areas, the proponents of competing values are going to insist that there be a clear-cut answer to the question, "Is there a need for expanded oil production?", before concurring in the designation of lands for such production. "If the test will be difficult for traditional sources of petroleum," Pearl stated, "it will be doubly difficult in the area of relatively untapped energy sources, such as tar sands and oil shale which remain virtually untested and untried."

The legal portion of the Commission's study, according to Pearl, will detail the applicability of the Mining Law (of 1872) and subsequently the Mineral Leasing Act (of 1920) to oil shale, together with their

PLLRC DIRECTOR DISCUSSES DEMAND FOR ENERGY FUELS (Continued)

amendments and interpretations, up through the Atomic Energy Act of 1954, along with the various Acts offering incentives or impediments for exploration, development and production. In all studies, the Commission will be high-lighting congressional intent and the manner of administrative execution.

Parallel to the legal portion of each study, the Commission will examine the energy resource itself from every aspect, including the effects of existing policies, focusing on the economic significance of energy fuels production and consumption in the U. S. related specifically to public lands production. Such background data will enable the Commission to assemble a complete analysis of the amount and value of production of each of the energy fuels from all the public lands.

Pearl concluded his presentation by stating that the final recommendations by the Commission will be made against a background that will include previous discussions of basic issues and a search for criteria by which to include standards as to what constitutes maximum benefit for the general public. For the first time an effort will have been made to evaluate scientifically the potential retention or disposition of Federally-owned resources.

NEW PLLRC APPOINTMENTS ANNOUNCED

Appointment of two assistant directors of the Public Land Law Review Commission was announced in February by Milton Pearl, the Commission director.

NEW PLLRC APPOINTMENTS ANNOUNCED (Continued)

Newly appointed are:

1. Harry L. Moffett, Assistant Director, Washington, D.C. Moffett, a lawyer, has been associated with the National Recovery Act and with the American Mining Congress, where he served for 30 years.
2. Charles Conklin, Delta, Colorado, also a lawyer, served as Speaker of the Colorado House of Representatives for 4 years, and held other Chairmanships with the Colorado House Rules Committee and with the Colorado Legislative Council.

Four House members were newly appointed to the Public Land Law Review Commission on January 31st and two House members were re-appointed. In addition to Chairman Wayne Aspinall, the membership of the Public Land Law Review Commission now is:

(Appointed by the President)
H. Byron Mock, Vice Chairman, Salt Lake City
Lawrence Rockefeller, New York City
Philip Hoff, Governor of Vermont
Robert Clark, Professor, Tuscon, Arizona
Maurice Goddard, Harrisburg, Pa.
Nancy Smith, San Bernardino, California

(Appointed by the President of the Senate)
Henry Jackson, D - Washington
Clinton Anderson, D - New Mexico
Alan Bible, D - Nevada
Thomas Kuchel, R - California
Gordon Allott, R - Colorado
Len Jordan, R - Idaho

NEW PLLRC APPOINTMENTS ANNOUNCED (Continued)

(Appointed by the Speaker of the House of Representatives)

Walter Baring, D-Nevada
Roy Taylor, D-North Carolina
Morris Udall, D-Arizona
John Saylor, R-Pennsylvania
Laurence Burton, R-Utah
John Kyl, R-Iowa

SASKATCHEWAN PERMITS LISTED

Presented below is a listing of the Oil Shale Permits in the Province of Saskatchewan, revised as of January 4, 1967. We know of no oil shale development activities in Canada, or of any oil shale permits in effect in other Canadian Provinces.

OIL SHALE PERMITS

PERMIT	HOLDER	ACREAGE	DATE
PS 1	Sun Oil Company	99,840	2-3-64
PS 2	Sun Oil Company	99,840	2-3-64
PS 6	Sun Oil Company	36,640	1-6-64
PS 7	Sun Oil Company	34,560	1-6-64
PS 8	Sun Oil Company	11,520	1-6-64
PS 10	Sun Oil Company	31,360	1-6-64
PS 18	Sun Oil Company	21,760	1-6-64
PS 19	Sun Oil Company	21,920	1-6-64
PS 20	Sun Oil Company	100,000	1-6-64
PS 64	Husky Oil Canada Ltd.	99,994	9-7-65

COLORADO OWNERSHIP MAP UPDATED

A fold-out map showing the February, 1967 status of ownership to oil shale mineral rights on lands in the Piceance Basin area of Colorado is presented inside the back cover of this report.

TECHNOLOGY

THE CER GEONUCLEAR PROJECT REVIEWED

The consortium of companies interested in the CER Geonuclear test proposal met in Dallas, Texas on January 18, 19 and 20 to discuss and refine details of the project.

Ashland Oil joined the consortium of companies, bringing to 25 the number of industrial companies now participating in the study of the test proposal, a study now known as Project Bronco.

Project Bronco is now organized as a joint effort involving twenty-five industrial companies, two government agencies and an operating contractor. As the initial operating contractor, CER Geonuclear Corporation proposes that the organization be as shown in Figure 1 on the following page. It was requested by CER Geonuclear that the participants make known to them the particular expertise of their employees who might be able to serve on the various subcommittees.

Negotiations

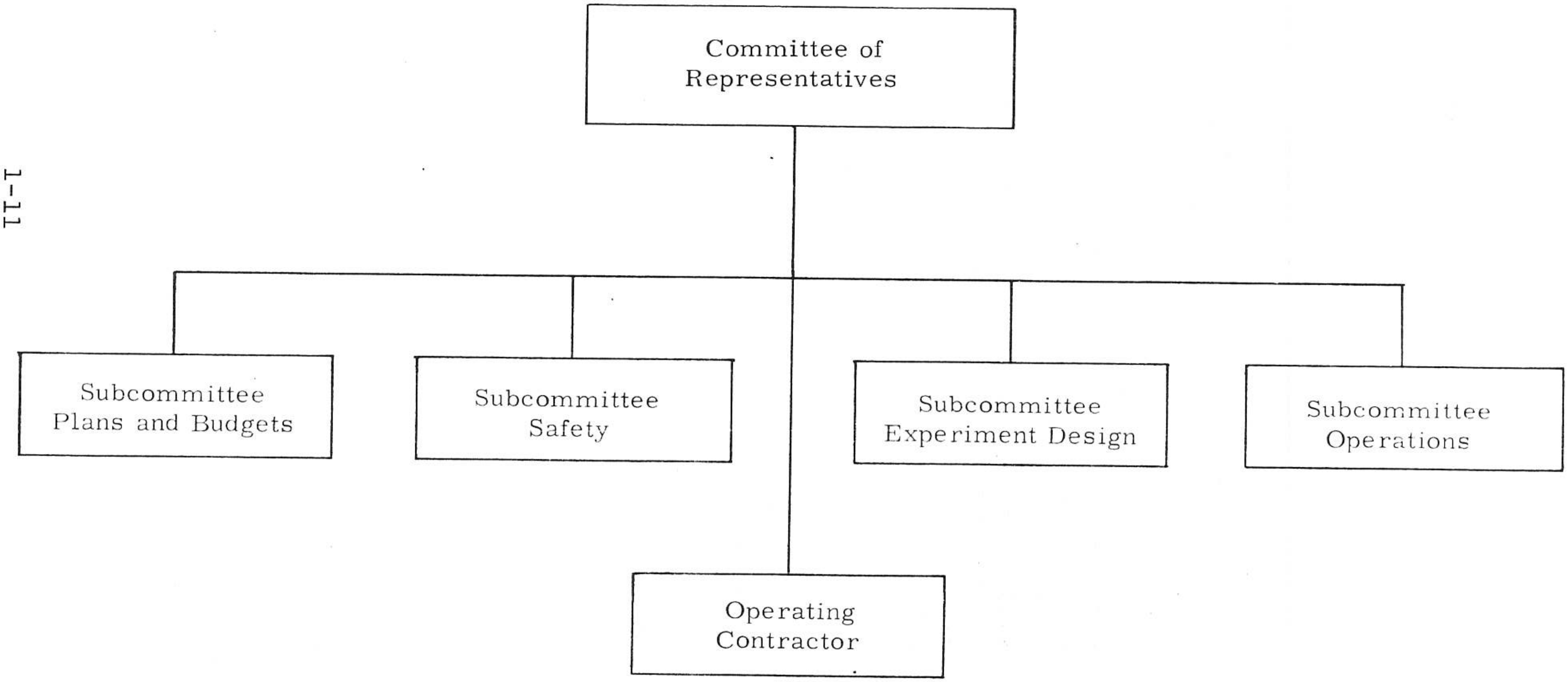
In December, CER Geonuclear prepared a draft contract, using the proposed operating agreement between the participants as a guide, which included the U. S. Government as a party. This draft was submitted to a commission of the Federal government for review.

It was established at a meeting with the commission in January that:

1. The industry group must be cautiously pessimistic in regard to patent rights which might derive from the experiment.

FIGURE 1

PROPOSED ORGANIZATION
PARTICIPATING GROUP
PROJECT BRONCO


Committee of Representatives
Subcommittee Plans and Budgets
Subcommittee Safety
Subcommittee Experiment Design
Subcommittee Operations
Operating Contractor

2. The government insists on making the land required for the test available under a lease arrangement, and

3. That the contract "boiler plate", as proposed, seems to be in order.

CER Geonuclear had proposed that the patents derived from the in situ retorting phases of the project (Phases II and III) be the property of the participants with royalty free rights to the Federal government. The Atomic Energy Commission appears to find this reasonable but the Bureau of Mines has taken the position that any patents obtained must be made available on a royalty free basis to third parties who are not participants of the project.

This stand by the Bureau of Mines follows the President's patent policy but it was pointed out that there could be some deviation if special circumstances could be shown. Because of this, the participants will submit to CER Geonuclear a resume' of their research and other activity in oil shale to permit a showing of special circumstances to be advanced.

The matter of obtaining Federal land for Project Bronco was initiated by a CER Geonuclear request (in the draft agreement) that the government grant a piece of land for conducting the experiment with the industry group having rights to produce and dispose of the oil as they see fit. The Department of the Interior prefers to modify the President's Withdrawal Order affecting oil shale and then to lease a small acreage to the group or to CER Geonuclear as project manager for experimental purposes.

Under the lease arrangement as proposed, it has been determined that CER Geonuclear would be the logical lessee in order to prevent the possibility that the participants might be barred from further leases if they, in fact, took the lease in joint tenancy. The proposal for leasing follows the standard terms as spelled out in the Mineral Leasing Act of 1920 with 100% royalty to the Federal government. Royalties and rents would be waived for a period of five years.

The government has taken the position that the project should involve a consideration of all minerals which might be affected by the experiment. This is a reference to the nahcolite and dawsonite minerals which have been discovered in the center of the Piceance Basin. The project will be modified to the extent necessary to consider the effect of the blast and the subsequent retorting of the nuclear chimney on the solubility and potential recovery of any of these minerals which may exist in the rubble filled chimney.

In general, CER Geonuclear is encouraged by the attitude and willingness of the Federal agencies involved to seek satisfactory means for conducting the project. Several of the industry group are not as optimistic and a proposal was made at the meeting that a small advisory group be set up to communicate with CER Geonuclear during these government negotiations. This will be done.

The industry group is prepared to consider conducting the experiment on private land if an impasse develops with the Federal government. The Atomic Energy Commission has expressed its feeling as preferring to conduct the experiment on private lands.

Safety Considerations of Concern to Project Participants

In other actions taken at the Dallas meeting it was decided to separate Phase I into two phases, one being the pre-shot investigation and the other being the actual shot plus the post-shot studies. This was done at the suggestion of one of the participants who wanted an opportunity to withdraw from the program after the site selection if, in their opinion, there was any question that the shot might be hazardous or that the location was not suitable for other reasons. As a result of this suggestion, the program will be so divided.

Also, it was decided by vote of the participants that the number of participant companies on the industry side should be a minimum of fifteen before the contract would become effective instead of ten as set forth in the current draft.

Feasibility Study Proposed

Finally, a proposal to conduct a feasibility study into the subject of carrying on some retorting tests in a simulated nuclear rubble filled chimney, probably on the site of the Anvil Points Experiment Station, prior to the actual retorting of the nuclear chimney was discussed. This proposal was advanced by Cameron and Jones, Incorporated and the Colorado School of Mines Research Foundation on a joint basis.

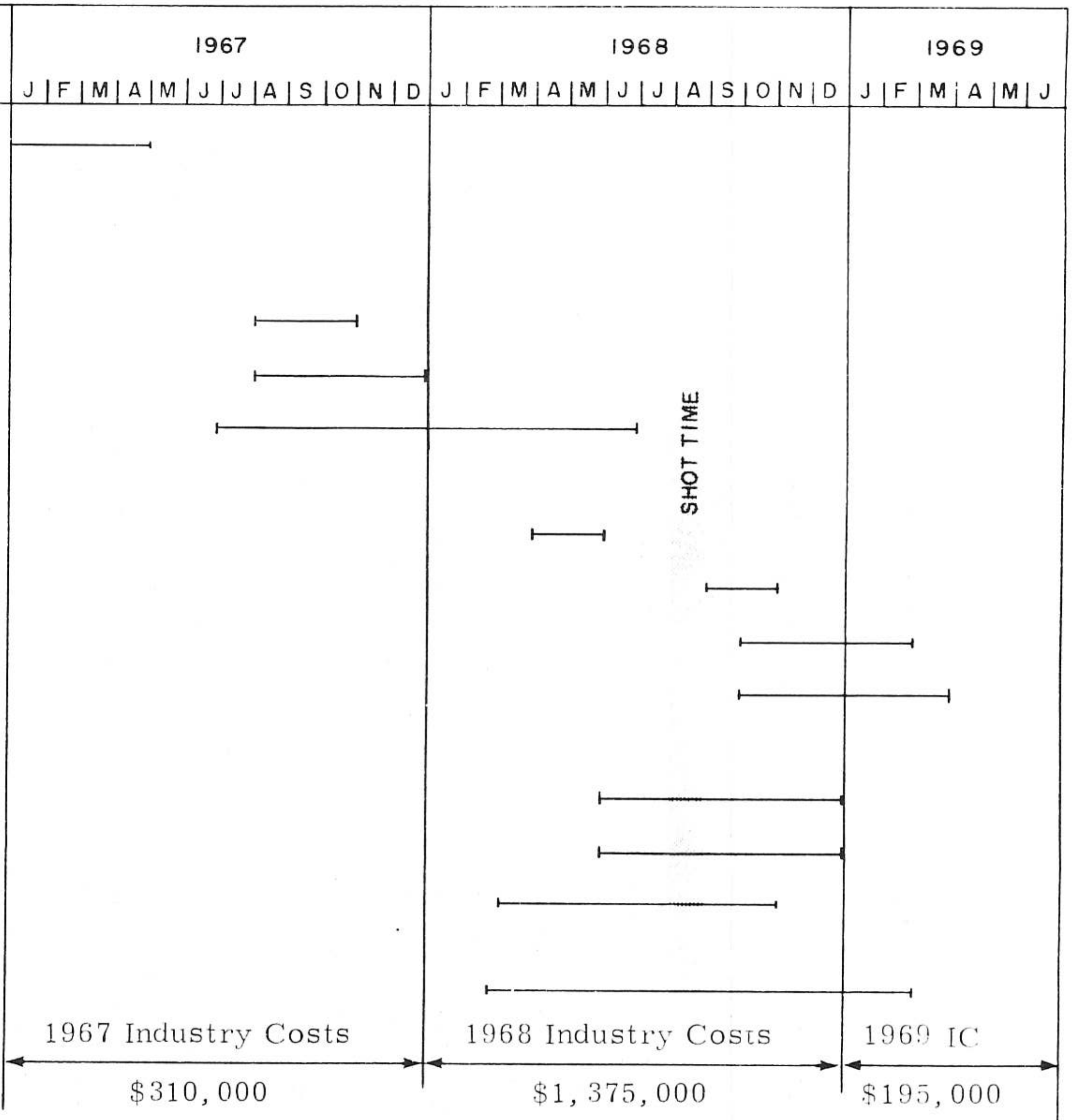
NOTE: At the time of this report publication date, a feasibility report on Project Bronco is in the process of being prepared jointly by the Atomic Energy Commission, the Lawrence Radiation Laboratory, CER Geonuclear Corporation and the Laramie Oil Shale Research Center (USBM).

Timing and Scheduling

Copies of a time schedule were furnished to the Participants showing time period involved in the various operations necessary in Phase I of the proposed test program. A copy of the time schedule is presented on the page that follows.

PROJECT BRONCO - PHASE I*

FUNCTION	ESTIMATED COST
Project Feasibility and Contract Negotiation	50,000
Project Site Exploration and Evaluation	-------
Preshot Exploratory Holes	150,000
Field and Lab Analysis	60,000
Project Planning and Design	62,000
Project Execution	-------
Emplacement Hole	140,000
Post Shot Reentry Wells	95,000
Post Shot Exploratory Wells	375,000
Field and Lab Analysis	135,000
Safety	-------
Seismic	60,000
Radsafe	30,000
Construction and Technical Support	260,000
Logistic Support	463,000
Total (Phase I)	1,880,000



*Assumptions: Shot time August 1968; Phase I ends March 1969; no CER work for AEC/Bu Mines shown; no CER fee in est. costs; 50,000 dollar item on first line represents balance of feasibility/contract negotiation which was half completed in December 1966.

Time and cost estimates subject to further refinements when program and schedules are finalized with U.S. government.

THE CER GEONUCLEAR PROJECT REVIEWED (Continued)

Economic Study Presented by CER Geonuclear

CER Geonuclear presented to the participants the results of an economic study of a commercial-scale nuclear in situ operation for recovering oil from oil shale. In a question-and-answer exchange, CER spokesmen stated that the study was made through rose-colored glasses, and asked that each participant prepare its own studies and make the results available to the CER Consortium. A copy of the CER economic study entitled, "Ultimate Cost Estimate -- Recovery of Shale Oil" is presented on the page that follows.

In the discussion of this study, CER noted that changing the lithology constant "C" from 325 to 290 results in a change of oil recovery from 3×10^6 Bbls to 22×10^6 Bbls., assuming the other factors are the same. It was also noted that by changing the in situ treatment from the assumed value to 1000 psi increases the compressor operating costs alone from approximately $.22/Bbl to the order of $.51/Bbl (3¢/MCF x 17,000 scf/Bbl) to say nothing of increased investment costs for higher horsepower and extra stages.

COMMERCIAL NUCLEAR IN SITU PROGRAM EXAMINED

The proposal by CER Geonuclear Corporation for an experimental program to test the concept of in situ retorting of crushed shale within an underground chimney produced by a 50 KT nuclear detonation suggests the need to consider the magnitude and economic aspects of a subsequent commercial-scale nuclear in situ retorting project.

Magnitude of Commercial Program

The scaling-up of a successful experimental nuclear in situ oil recovery test program to one of commercial production significance, as presently envisioned, will

ULTIMATE COST ESTIMATE
RECOVERY OF SHALE OIL

ASSUMPTIONS

Cavity Lithology Factor c = 325

1. 200 KT @ 3000 ft. Rc = 210 ft., Hc = 1050 ft.,
   Tons Rock 7.3 x 10^6, Bbls Kerogen 4.4 x 10^6
2. After Commercialization.
3. 70% Recovery. Oil Recovered 3 x 10^6 Bbls., at 5000 Bbl/Day.
4. Air Rate 17,000 scf/Bbl Recovered Oil; 50 psi Operating Pressure.

INVESTMENT

Breakage of Rock

1.	15 inch ID Emplacement Hole	$100,000
2.	Device, Safety, Timing, and Firing	300,000
	Cost of Recovered Oil per Bbl = $.13	$400,000

Oil Recovery

1.	Re-entry of Emplacement Hole + 1 Additional Air Injection Well	$120,000
2.	Four 12 inch Production Wells @ $40,000	160,000
3.	Surface Storage, Lines, Treating Equipment	80,000
4.	Compressors @$150/BHP, 20 Year Life	180,000
	Cost of Recovered Oil per Bbl = $.18	$540,000

OPERATING COST

1.	Compression @ $28/BHP - Year Based on Fuel Cost 10 scf/BHP at $.30/mcf + Maintenance	$650,000
2.	Treating Cost @ $.10/Bbl	300,000
	Operating Cost per Bbl = $.32	$950,000

GRAND TOTAL - $.63/Bbl Recovered Oil

DOES NOT INCLUDE: Lifting Cost for Oil, Lease Expense, Royalty, Administrative Expense, etc.

utilize one or more production caverns (rubble-filled chimneys), each produced by a 200 kiloton nuclear detonation. These detonations would probably be initiated at the same depth as that proposed for the experimental test blast, namely 3000 feet, and would create chimneys 420 feet in diameter and 1050 feet high, each containing 142 million cubic feet in volume. The commercial chimneys would be formed on 1200 foot centers and, most likely, would not be less than four in number.

Process Summarized

A commercial program would be conducted in an oil shale formation having an average of 25 gallon-per-ton shale with no section (layer) over 75 feet in thickness containing less than 12 gallons of oil per ton of shale. The rubble pile contained in each chimney would contain approximately 7.3 million tons of fragmented oil shale containing the equivalent of 4.4 million barrels of oil. The rubble in each chimney would be retorted *in situ* by introducing combustion air, with or without recycle gas, and initiating combustion within the bed of broken shale. Gas compressors installed at the surface of the ground would deliver combustion air and any necessary recycle gas, via pipes, into the upper portion of the rubble-filled chimney. The heat of combustion would provide all necessary heat for pyrolysis of the kerogen in the oil shale rubble.

It is visualized that a fire front or heat front could be propagated and controlled so as to progress downward at a rate of possibly one foot per day, ultimately passing through the bed of broken shale. Oil, as mist and as vapor, would progress in the gas stream ahead of the heat front and would be drawn from near the bottom of the chimney and be delivered at the surface for recovery of liquid oil values from the off-gas product. The compressors would furnish all necessary power to overcome the total pressure drop across the bed of shale as well as friction losses in entry and withdrawal pipes.

Possible Problems

The pressure drops to be encountered in the rubble-filled chimney would be theoretically quite negligible ("a few psi") as compared to head losses in the air or air/gas injection and draw-off piping runs. It is considered quite probable that problems would be encountered during retorting which would increase the total pressure drop drastically. One of the problems to be anticipated (from results of retorting tests conducted by the Bureau of Mines on various grades of oil shale) relates to the observation that rich oil shale fragments lose physical strength after being retorted and tend to crumble. The retorting operation removes the kerogen which apparently is the "cementing material" of the shale. With the removal of kerogen, shale crumbles easily into fines. The physical stability of oil shale has also been shown to decrease rapidly following complete burning and removal of the carbon residue. Thus, it is to be anticipated that the pressure drop across the rubble pile could increase possibly tenfold over the theoretical calculation, following retorting and combustion of the oil shale rubble due to the compacting effect in the bed of solids and the resultant loss of porosity.

Any water from aquifers or from the oil shale formations would have an adverse effect on retorting, should the water infiltrate and accumulate in (or completely fill!) the chimney. While it may be possible to "seal off" aquifers, we visualize that some considerable increase in gas "operating" pressure will be necessary during retorting in order to balance or overcome the "formation pressure" and prevent infiltration of water from the formations. This would increase the compression power requirements.

COMMERCIAL NUCLEAR IN SITU PROGRAM EXAMINED (Continued)

Power Requirements Examined

The total power requirements for any nuclear in situ program will be dominated by the gas compression horsepower requirements.

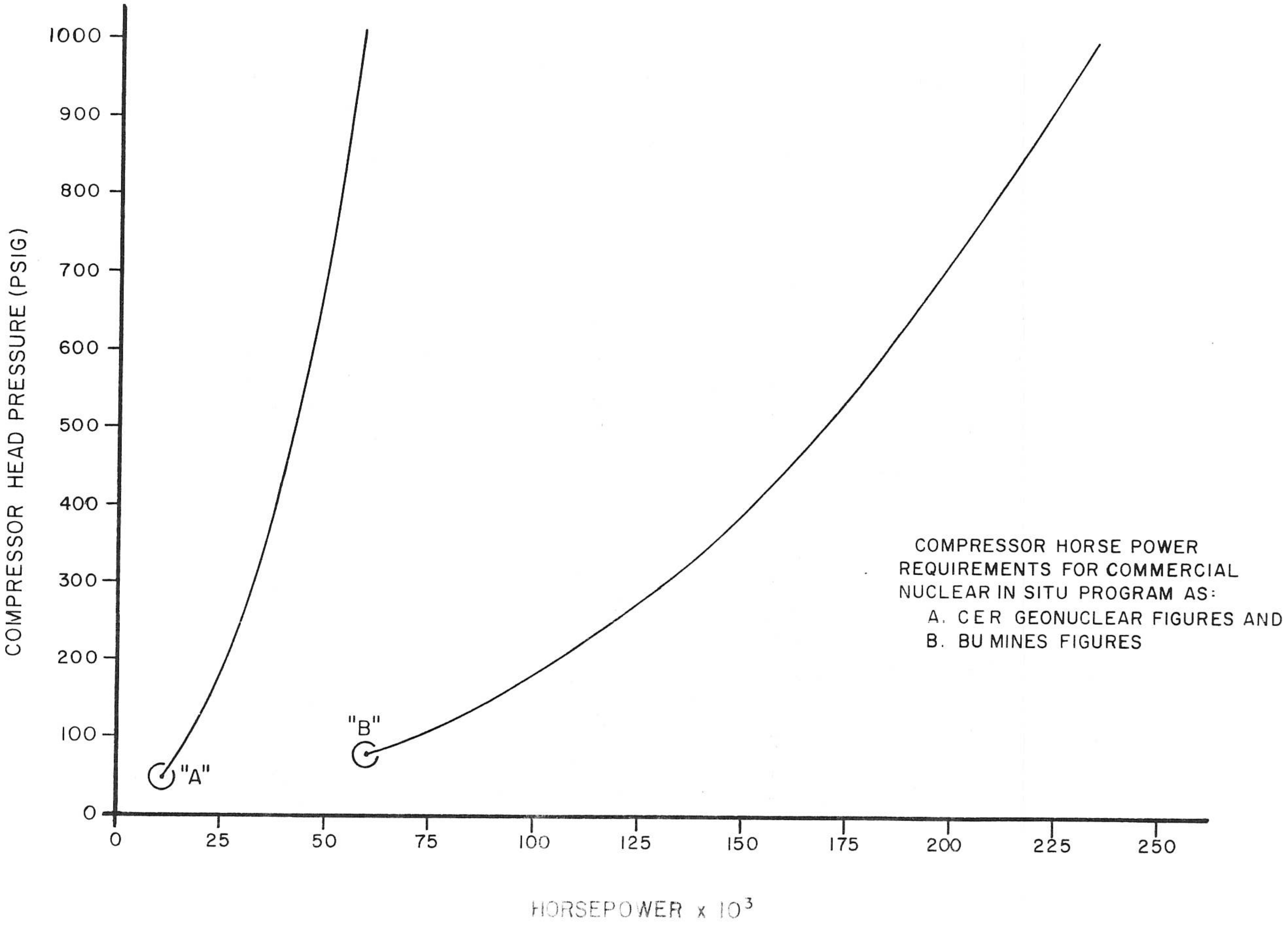
Since so many unknowns exist, such as the precise effect on pressure drop by such phenomena as infiltrating water, crumbling of spent shale fragments, and possible quantities of necessary recycle gas, we present a graph which presents our estimates of the possible power requirements of a single 200 KT commercial in situ operation.

Point "A" on the curve represents the gas compression power requirement estimated by CER Geonuclear Corporation. This assumes a 50 PSIG compressor discharge pressure, 59,000 CFM air requirement and no recycle gas requirement.

Point "B" represents possible gas compression power requirements if air quantities of 120,000 SCFM and recycle gas quantities, also of 120,000 SCFM are used, as suggested by USBM retorting experience. Larger injection and draw-off wells are assumed for the increased flow rates. The curves originating at points A and B represent possible gas compression power requirements if respective gas quantities are used. The curves anticipate that operating pressures must be increased to as much as 1,000 psig to prevent water infiltration, and to overcome the crumbling and packing of spent shale after retorting.

STEAM THERMAL IN SITU TEST UNDERWAY IN WYOMING

The Bureau of Mines commenced putting 1000°F steam to fractured oil shale formations on February 17th. The in situ field test experiments, located between Green River and Rock Springs, Wyoming, were discussed in detail in the December 1, 1966 issue of this Quarterly report.



COMPRESSOR HORSE POWER
REQUIREMENTS FOR COMMERCIAL
NUCLEAR IN SITU PROGRAM AS:
A. CER GEONUCLEAR FIGURES AND
B. BU MINES FIGURES

IGT PUBLISHES FINAL REPORT ON HYDROGASIFICATION

A 109-page report by the Institute of Gas Technology having the subject title was made available early this year. This comprehensive report represents the culmination of a five-year program undertaken by the Institute for the Gas Operations Research Committee of the American Gas Association as sponsors. The report includes detailed descriptions of the program phases and is well supported with flow sheets and tables. The document is available as IGT Research Bulletin No. 36 at $5.00 per copy. Previous issues of this quarterly report have included interim research results published by the Institute and a summary of their work and final report follows.

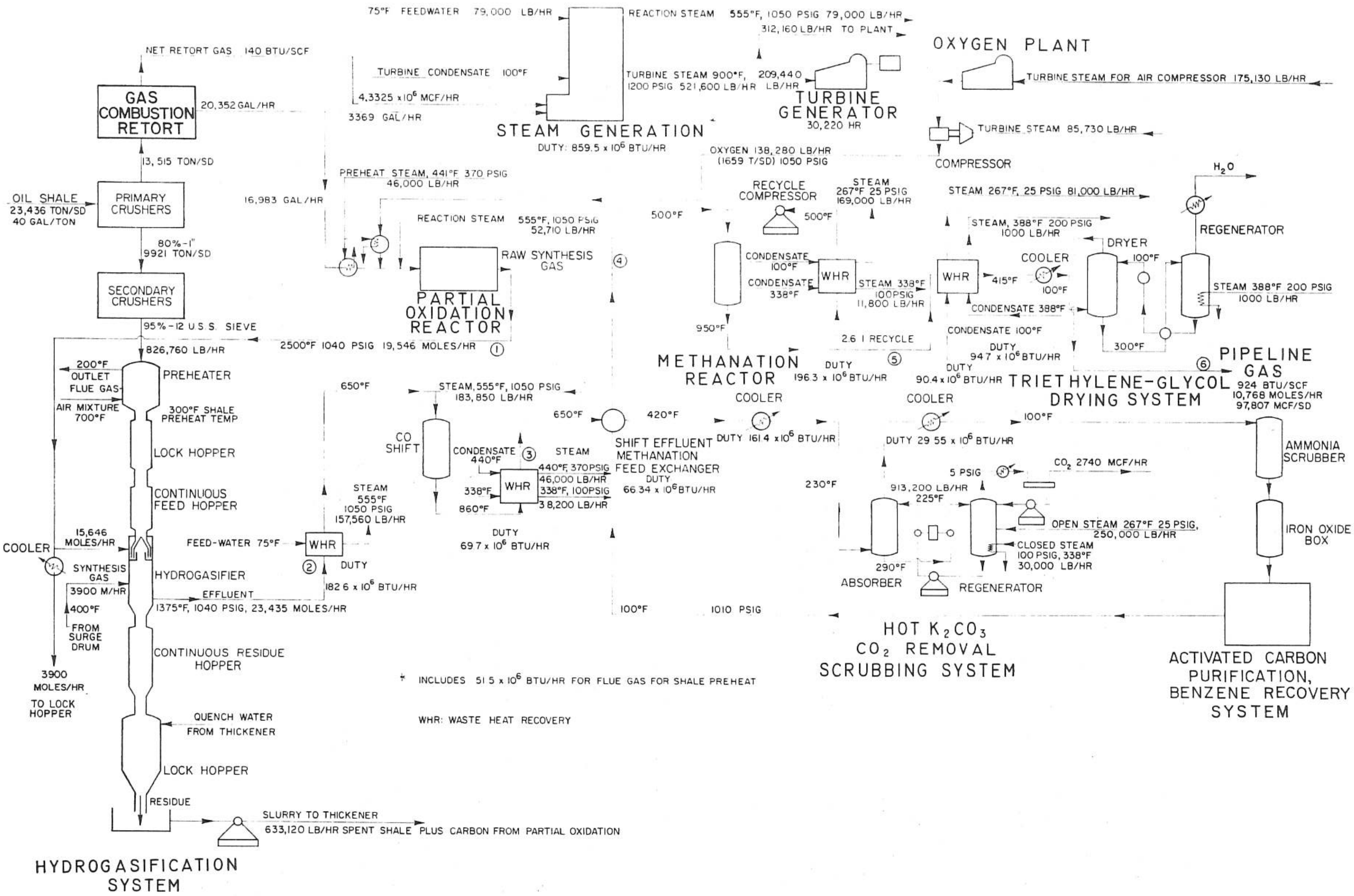
The test program began in 1959 after preliminary work by IGT in 1953 revealed encouraging results in the direct hydrogasification of oil shale. The process of hydrogasification involves the direct conversion of organic matter to methane, propane, and other natural gas hydrocarbons by exposing it to high pressures and temperatures in a hydrogen atmosphere. This process thus eliminates the steps of retorting and hydrogenation of shale oil when the desired end product is a high Btu (natural gas equivalent) gas.

Shale Properties and Lab Scale Tests

The report begins with a presentation of the physical and chemical properties of oil shale from areas examined; e.g., Colorado, Eastern U. S., and New Brunswick (Canada) formations. Following the sample analysis report, the laboratory-scale batch reactor studies are described. The laboratory apparatus which consisted of a one liter reactor vessel mounted in a 4.5 KW electric furnace was supported on a rocking mechanism which provided sample agitation during the tests. A complete description of the sampling and instrumentation equipment is included as well as the various reactor designs utilized, the latter being appended to the report. Test runs were conducted to examine process variables during short and long residence times and for simulated continuous processing. Variables examined for a 35.9 gallon per ton Colorado oil shale sample included temperature, pressure, individual component yield, hydrogen/shale ratio, and particle size. These experiments were run in order to establish the interrelations between parameters by a well organized statistical analysis procedure. All test results are summarized graphically in the main body of the report with complete test run data sheets appended. The results of additional comparison tests run on several eastern U. S. shales and samples from the Alberta formation are tabulated in the text. Finally the batch test results are shown to be useful in computing gross reserves of a natural-gas-equivalent product based on 1035 Btu/SCF with a formula originated by IGT utilizing, in addition, Fischer Assay values.

"Semiflow" Studies

The next phase of the research program consisted of what is described as "laboratory semiflow reactor studies". The rather sophisticated equipment arrangement is again fully described and similar variables as with the batch tests were examined for semiflow operation which involves a stationary shale sample and flowing gas. An optimum range of operating conditions resulted from these experiments which could be used for pilot plant scale work. Areas of prime importance which were examined involved producing a high methane-ethane gas and establishment of the major design parameter of H_2/shale ratio. The final series of semiflow test results additionally provided information useful in predicting costs of producing pipeline quality gas from oil shale. Complete test run tabulations and graphical summaries support the report's description of semiflow operations.



* INCLUDES 51.5 x 10^6 BTU/HR FOR FLUE GAS FOR SHALE PREHEAT

WHR: WASTE HEAT RECOVERY

FLOWSHEET OF 90 X 10^9 BTU/SD PLANT FOR PRODUCTION OF PIPELINE GAS BY HYDROGASIFICATION OF OIL SHALE WITH HOT, RAW SYNTHESIS GAS

SOURCE: Institute of Gas Technology

Pilot Scale Tests

The final experimental phase of the program involved the construction and operation of continuous processing equipment which though not being much larger than the lab scale equipment schemes, was capable of results which could be more easily scaled up to commercial work. Optimum operating parameters were tightened and the additional effects of shale space velocity and various diluent-hydrogen gas mixtures were examined in these pilot studies. Fluidized bed, moving bed, and free fall arrangements were studied with the former proving definitely unsatisfactory. In addition counter-current and cocurrent gas flow experiments were conducted with the conclusion being that cocurrent operation was the most suitable. Again the pilot phase report includes graphical and tabular data presentations as well as appended test run data sheets.

Heat Studies

Following the actual test work, the researchers examined the technical literature for information relating to the heat effects of the reaction. The available data on the sensible heat of reactants and products and various heats of reaction were combined with the test data in order to establish complete heat and material balance calculations. A study of the heat of hydrogasification was made and heat economy techniques were examined theoretically particularly in regard to the use of hot, raw synthesis gas, which later in this review is shown to be an economically sound approach.

Process Economics

The final phase of the program involved a detailed examination of the process economics on the basis of processing 40-gallon-per-ton Colorado oil shale to produce 90×10^9 Btu per stream day of pipeline gas. The following tables, reproduced with permission from the original

ANNUAL OPERATING EXPENSES OF 90 X 10^9 BTU/SD PLANTS FOR HYDROGASIFICATION OF 40 GAL/TON COLORADO OIL SHALE WITH SYNTHESIS GAS

A.G.A. Accounting Procedure,* 95% Stream Factor

Hydrogen/Shale, % of stoichiometric	61.5	32.5	0
Shale	$ 5,847,500	$ 5,570,400	$ 8,001,100
Other Direct Materials (rods, mill liners, chemicals, catalysts)	310,000	288,300	410,100
Direct Operating Labor	1,393,900	1,345,000	1,442,900
Maintenance (3% of bare cost)	1,511,300	1,459,700	1,907,600
Supplies (15% of Maintenance)	226,700	219,000	286,100
Supervision (10% of Direct Operating Labor)	139,400	134,500	144,300
Payroll Overhead (10% of Direct Operating Labor and Supervision)	153,300	148,000	158,700
General Plant Overhead (50% of Operating Labor, Supervision, Maintenance, and Supplies)	1,635,600	1,579,100	1,890,400
Depreciation (5% of Total Fixed Investment)	2,849,300	2,752,000	3,596,400
State and Local Taxes and Insurance (3% of Total Fixed Investment)	1,709,600	1,651,200	2,157,800
Total Operating Cost Before Contingencies	$15,776,600	$15,147,200	$19,995,400
Contingencies (2%)	315,500	302,900	399,900
Total Operating Cost	$16,092,100	$15,450,100	$20,395,300
Byproduct Credits			
Benzene plus Other Liquid Products (fuel oil equiv, 0.65¢/lb)	1,360,900	1,049,600	1,633,700
Ammonium Sulfate ($32/ton)	264,400	264,400	264,400
	$ 1,625,300	$ 1,314,000	$ 1,898,100
Net Operating Cost	$14,466,800	$14,136,100	$18,497,200
20-yr Avg Return on Investment	2,141,800	2,069,100	2,708,900
20-yr Avg Federal Income Tax	1,228,100	1,186,500	1,554,500
Total 20-yr Avg Annual Revenue Requirement	$17,836,700	$17,391,700	$22,760,600
20-yr Avg Price of Gas, ¢/MMBtu	56.9	55.6	73.1

ANNUAL OPERATING EXPENSES OF 90 X 10^9 BTU/SD PLANTS FOR HYDROGASIFICATION OF 40 GAL/TON COLORADO OIL SHALE WITH PROCESS HYDROGEN

A.G.A. Accounting Procedure,* 95% Stream Factor

Hydrogen/Shale, % of stoichiometric	61	36	0
Shale	$ 6,157,900	$ 6,280,000	$ 7,898,500
Other Direct Materials (rods, mill liners, chemicals, catalysts)	354,000	333,300	363,700
Direct Operating Labor	1,540,700	1,516,200	1,222,800
Maintenance (3% of bare cost)	1,591,800	1,538,300	1,612,700
Supplies (15% of Maintenance)	238,800	230,700	241,900
Supervision (10% of Direct Operating Labor)	154,100	151,600	122,300
Payroll Overhead (10% of Direct Operating Labor and Supervision)	169,500	166,800	134,500
General Plant Overhead (50% of Operating Labor, Supervision, Maintenance, and Supplies)	1,762,700	1,718,400	1,599,900
Depreciation (5% of Total Fixed Investment)	3,001,000	2,900,100	3,040,500
State and Local Taxes and Insurance (3% of Total Fixed Investment)	1,800,600	1,740,100	1,824,300
Total Operating Cost Before Contingencies	$16,771,100	$16,575,500	$18,061,100
Contingencies (2%)	335,400	331,500	361,200
Total Operating Cost	$17,106,500	$16,907,000	$18,422,300
Byproduct Credits			
Benzene plus Other Liquid Products (fuel oil equiv, 0.65¢/lb)	1,531,900	1,624,000	1,633,700
Ammonium Sulfate ($32/ton)	260,000	260,000	260,000
	$ 1,791,900	$ 1,884,000	$ 1,893,700
Net Operating Cost	$15,314,600	$15,023,000	$16,528,600
20-yr Avg Return on Investment	2,256,500	2,184,100	2,302,800
20-yr Avg Federal Income Tax	1,294,000	1,253,300	1,324,600
Total 20-yr Avg Annual Revenue Requirement	$18,865,100	$18,460,400	$20,156,000
20-yr Avg Price of Gas, ¢/MMBtu	60.7	58.6	64.7

* The gas prices presented in this Bulletin are 20-year average prices, computed by a procedure developed by the General Accounting Committee of the A.G.A. The procedure is based on the financing of utility gas plants at 65% debt and 35% equity. Straight-line depreciation over a 20-year period is assumed, and interest at 5% on the outstanding debt is charged. A 7% return on the undepreciated capital investment is assumed. The federal income tax rate is 52%. The 20-year effective average capital charge composed of federal income tax, debt, and net income amounts to about 5.8%.

SOURCE: Institute of Gas Technology

report, compare plant operating costs with and without using raw synthesis gas. 50¢ per MMBtu is considered the attainable minimum production cost for hydrogenation of 25-30 gallon per ton Colorado oil shale. Figures shown in these tables are based on 1960-62 cost data.

Summary

In summary the report presents a very detailed picture of the research program conducted and develops an apparently sound process for commercial application. Of particular value is the complete test data and the Institute's recommendation on the important hydrogen/ shale ratio as an operating parameter. The economic analysis demonstrated that a value of one third of the stoichiometric feed hydrogen requirement is the most feasible. The suggested commercial process utilizes flue gas to preheat the shale feed to 300°F followed by the mixing of the preheated shale and 2500°F synthesis gas to arrive at a mean temperature of 1050°F, sufficient to initiate the self-sustaining hydrogasification reaction. The proposed commercial process is depicted on the following page in flow sheet form. The exact value of the work done will be better appreciated when the reserves of our natural gas reach the point where synthetic methane production will be needed to supplement this energy source. The organizations responsible for this work are to be commended for their foresight in laying the groundwork here and in their previous reports (natural gas production from gasoline and oil) for an industry that is yet to be required but one which we must be prepared for. Their report (Research Bulletin No. 39) now in preparation and concerning the production of pipeline gas by hydrogasification of coal will be reviewed when released.

MATHEMATICAL MODEL UTILIZED TO ILLUSTRATE IN SITU PROCESS

In a paper entitled, Conduction Heating of Formation With Limited Permeability by Condensing Gases*, H. A. Lesser of Esso Production Research Company formulated a mathematical model that represented the conduction heating of a rock formation of limited permeability. For his calculations, Lesser assumed that the formations would have equally-spaced horizontal fractures into which a hot condensing gas can be injected. Lesser applied his model to the prediction of the in situ heating of oil shale, with four sample cases. He illustrated the influences that shale thermal diffusivity, fluid pressure in the fractures, and fracture spacings have on the heating rate of the shale.

In all cases considered, several years were required to heat all the formations to 700°F with 1000°F steam. In all cases, less than 32 percent of the injected heat was utilized for heating the shale.

Low heating efficiencies of the process result from the fact that once the outlet temperature reaches the saturation temperature, an appreciable amount of heat begins to be produced at the production well. Thereafter, the cumulative utilization of heat decreases rapidly.

If an injection pressure of 400 psia is used instead of 1000 psia, the heating process is slowed, according to Lesser's calculations. This behavior results from the lower steam saturation temperature which causes a smaller temperature gradient at the fracture.

With injected steam at 1000°F, 4 to 11-1/2 years were required to heat all the oil shale formations to 700°F.

---

*Lesser, H. A., et.al. Conduction Heating of Formations With Limited Permeability of Condensing Gases, Society of Petroleum Engineers Journal, Vol. 6, No. 4, Pages 372-378, December 1966.

THE OIL SHALE CORPORATION (TOSCO) REVIEWED

Subscription Offer by TOSCO for Additional Stock Sales

The Oil Shale Corporation filed with the Securities and Exchange Commission a copy of a Prospectus which discloses that the company is offering, to holders of its Common Stock, rights to subscribe to an additional 7,969,586 shares of stock. Information of general interest concerning the Oil Shale Corporation was disclosed in this public document. Under separate headings, certain of these data will be reviewed.

The Company

The Oil Shale Corporation was incorporated under the laws of Nevada on September 16, 1955. Its principal offices are in New York City and in Denver, Colorado. Since its inception, the company has been carrying on research and development of processes for the production of oil from oil shale. It has paid or accrued to December 15, 1966 approximately $19,400,000, of which approximately $6,900,000 was for research, development and related purposes, approximately $4,500,000 for general, administrative and similar costs and expenses, approximately $5,800,000 (paid) for the acquisition of oil shale reserves, and approximately $2,200,000 for property, equipment and patents and patent applications.

Under existing obligations the company is committed to expend approximately $2,000,000 for acquisition of oil shale reserves.

The New Subscription Offer

Holders of Common Stock are offered rights to subscribe at the price of $1.00 per share, for an aggregate of 7,969,586 additional shares of Common Stock on the "Primary Subscription Right" basis of two additional shares for each one share now held. An "Over-Subscription

Privilege" permits those who fully exercise their primary rights to subscribe for additional shares up to three times the number of shares now held, at the subscription price of $1.00 per share so long as a sufficient number of shares are available.

Aquitaine Oil Corporation and Auxirap Corporation of America

"Aquitaine" is a wholly-owned subsidiary of Societe Nationale des Petroles d'Aquitaine, a French corporation engaged in production, manufacturing and sale of hydrocarbon products. Aquitaine owns 253,000 shares of TOSCO Common Stock and will receive rights to purchase an additional 506,000 shares.

"Auxirap" is a wholly-owned subsidiary of Entreprise de Recheres et d'Activities Petrolieres, a French Government Corporation which also owns approximately 51% of the securities of Societe Nationale des Petroles d'Aquitaine. Auxirap owns 253,000 shares of TOSCO Common Stock and will receive rights to purchase an additional 506,000 shares.

Each of Aquitaine and Auxirap has advised TOSCO that it intends to exercise all of such rights.

TOSCO has advised to each of Aquitaine and Auxirap that TOSCO will offer (promptly after the Expiration date) to each of Aquitaine and Auxirap at $1.00 per share, a number of shares equal to 50% of the difference between the total numbers of shares offered under the Prospectus and the total number of shares issued.

As a result of these offers and proposed offers, the proportion of ownership by Aquitaine and Auxirap of TOSCO Common Stock may be increased from its present 6.34% now owned by each, to a maximum ownership of 35.44% by each of the two companies.

Use of Proceeds

If all 7,969,586 shares of Common Stock are sold, of the net proceeds received by the company $750,000 together with interest thereon will be used to repay the loan from First National City Bank; $3,500,000 together with interest thereon will be used to repay the secured borrowing from Aquitaine. Approximately $ (*) will be used as operating costs of the semi-works facilities at Parachute Creek, near Grand Valley, Colorado; approximately $(*) will be used for payments on properties and reserves acquired by the company; and approximately $ (*) will be used for the Company's continuing programs of research and development. The balance of such proceeds will be added to the general funds of the company and will be available as working capital for general corporate purposes. In the event that less than all of the shares of Common Stock are sold, the available proceeds will be used first for payment of borrowings from First National City Bank and from Aquitaine.

* Figures were omitted (by TOSCO) from the SEC Prospectus.

Capitalization

The capitalization of TOSCO as at December 15, 1966, and as adjusted to give effect to the maximum sale of 7,969,586 shares of Common Stock and the use of the proceeds therefrom is shown in the table on the following page.

Capitalization

	Authorized	Outstanding	To be Outstanding
6% Converticle Debentures due June 30, 1968...........	$ 300,000	$ 300,000	$ 300,000
5% Convertible Subordinated Notes due December 1, 1979..	$ 6,590,000	$ 6,590,000	$ 6,590,000
6 3/4% Promissory Note due April 15, 1967..............	$ 750,000	$ 750,000	None
6 3/4% Secured Promissory Note due May 16, 1967.......	$ 3,500,000	$ 3,500,000	None
5 3/4% Secured Promissory Note due December 27, 1975..	$ 180,000	$ 167,455	
Preferred Stock, $1 par value	1,000,000 shs.	None	None
Common Stock, par value $0.15 per share.............	7,000,000 shs.	3,984,793 shs.	11,954,379 shs.

Production and Production Joint Venture

Upon the formation of the Joint Venture, TOSCO, Sohio Petroleum Company and The Cleveland-Cliffs Iron Company undertook to construct a semi-works facility for the purpose of demonstrating the commercial feasibility of the technology, determining optimum design and minimizing the potential problems of scale-up. The Venturers established Colony Development Company ("Colony"), a corporation owned by them in proportion to their Venture interests, as an Agent for each of them to construct a 1,000 tons per day semi-works plant and related mine and other facilities on oil shale reserves near Grand Valley, Colorado held by them under option from Dow Chemical Company. Construction of the plant, with design based on TOSCO's production systems, was completed in June, 1965. Mine development was begun in the fall of 1964 and approximately 350,000 tons of oil shale have been mined.

The semi-works plant and mine were initially operated for the Venture by Colony, which utilized its own staff as well as personnel from each of the three Venture companies. In September, 1966 Sohio Petroleum Company and The Cleveland-Cliffs Iron Company notified TOSCO that they desired to suspend operation of the semi-works plant, pending further study. TOSCO proposed that it take over the operation of the semi-works plant. In accordance with an agreement among the Venturers effective as at September 22, 1966, TOSCO is now operating the semi-works plant at its own cost and The Cleveland-Cliffs Iron Company is operating the semi-works mine at the pro rata cost of the three Venturers. The operational responsibilities of Colony have been terminated. The agreement is effective until March 1, 1967 with respect to the plant and January 16, 1967 with respect to the mine.

To December 15, 1966 TOSCO paid or accrued approximately $3,100,000 as its share of the cost of the operations of Colony and paid or accrued approximately

$ (*) in connection with its own operations of the semi-works plant and as its share of the operations of the mine. It is anticipated that up to $ (*) of the proceeds of this offering will be similarly applied.

* Figures were omitted (by TOSCO) from the SEC Prospectus.

Agreement Provisions for Commercial Shale Oil Plants

On the basis of the information and data being developed in these operations, and designs and cost estimates now being developed, TOSCO will determine whether it will go forward to construction of a plant complex for production on a commercial basis. No such determination has been made to this time by TOSCO or by either of its Joint Venturers. The agreements among the Venturers contain various provisions governing the construction of commercial shale oil plants. The following summary is not intended to be complete.

Each party holding an interest of 30% or more in the reserve for which the plant is to be constructed generally has the right to propose such plant construction. The first plant must be proposed on the property under option from Dow Chemical Company. No subsequent plant may be proposed except after the expiration of twelve months of normal operation of the first plant. In addition, a subsequent plant may not be proposed for a reserve which has been held for less than six months.

TOSCO is not precluded by the terms of its Venture agreements from undertaking commercial production along or in association with persons other than its Joint Venturers except in connection with oil shale reserves jointly held by the Venturers where certain restrictions apply. In the event of such production TOSCO would be obligated to pay a fee to Technikoil, Inc. if it used the processes and technologies owned by or exclusively licensed to that company.

THE OIL SHALE CORPORATION (TOSCO) (continued)

Upon the proposal by any Venture party of a plant to serve a Venture reserve, the other Venture parties may elect to join in such construction. The proposals and any such elections must be accompanied by acceptable evidence of financial ability. If the proposed plant is the first plant, any party which does not participate must withdraw from the Venture and surrender its rights, at cost (as defined), in the property under option from Dow Chemical Company, except that TOSCO may elect to reduce its interest in the Venture to not less than 10%. If the proposed plant is a plant subsequent to the first plant, a party which elects not to participate must withdraw, at cost, from the reserve for which the plant is proposed, but is not required to withdraw from the Venture.

None of the Venture participants has to date made a proposal under the agreements with respect to the construction of any commercial plant.

Pipeline Transportation

A party proposing a plant specification for the first plant must state in such proposal the arrangements it has made for pipeline transportation of oil. With respect to a first plant Sohio Petroleum Company shall have the right to provide transportation facilities to the nearest available common carrier pipeline, provided that such facilities are competitive with other carriers and provided further that the average of the proposed tariffs to three selected principal mid-western markets is no higher than the average of the proposed tariff of any other proposed carrier.

Market

Unless the plant owners unanimously agree to the contrary, oil produced from any plant will be offered for sale in the marketplace. In addition, subject to satisfactory oil transportation arrangements, Sohio Petroleum Company has agreed to stand by to purchase all oil produced from the first plant meeting specifications and not sold to others, for a price of approximately \$2.20 a barrel at the plant gate (or \$2.25 per barrel at Rangely, Colorado). (The price to be paid by Sohio Petroleum Company is tied to an index of posted prices of major producers in three major United States fields providing sweet crude oil.) The agreement of Sohio Petroleum Company to stand by is for a term of fifteen years after the commencement of production and relates to the amount of crude oil produced from the processing of up to 80,000 tons of shale rock per day. At any time that the Venture is delivering more than one-half of its production to others, the price to be paid by Sohio Petroleum Company for the crude oil purchased by it under the stand-by agreement shall be the weighted average price of all such deliveries to others rather than the prices above referred to. In consideration of its agreement to stand by to purchase, Sohio Petroleum Company shall receive from the Venture in respect of all oil sold other than at the prices of \$2.20 or \$2.25 (as adjusted by the weighted average price referred to) the first five cents of the excess over the guaranteed price and two-sevenths of all additional excess amounts up to a maximum of fifteen cents per barrel of oil.

At the option of TOSCO and of The Cleveland-Cliffs Iron Company, the stand-by agreement of Sohio Petroleum Company may be converted into a firm purchase and sales contract for the entire production of a plant processing up to 80,000 tons of shale rock per day. The price at which crude oil is to be delivered under this agreement will be \$3.00 per barrel at Toledo, Ohio, subject to certain adjustments. If TOSCO and The Cleveland-Cliffs Iron Company exercise this right, the converted agreement will continue for a period of seven years, during which time Sohio Petroleum Company will be paid a stand-by fee, after which the stand-by undertakings of and fees to Sohio Petroleum Company will go into effect for the remaining period of eight years.

Processes, Technologies and Licensing

Pursuant to agreement the Joint Venturers have formed a corporation (Technikoil, Inc.) to act as the repository of jointly developed technologies and of certain technologies developed by the individual Venturers relating to oil shale production. Technikoil, Inc. is owned by the Venturers in proportion to their interests in the Venture.

Pursuant to agreement TOSCO has assigned to Technikoil, Inc. certain patents, patent applications and know-how and technical information and in addition has granted to Technikoil, Inc. an exclusive license to certain other technical material insofar as it relates to oil shale and other solid hydrocarbons. TOSCO, and each of the other two Joint Venturers, is contractually obligated for a certain term and under certain conditions, to assign, license, or grant to Technikoil certain other rights in such technical material arising or developed in the future. All such technical material developed by the Venturers jointly, through Colony Development Company or otherwise, will, for a certain term under certain conditions, be assigned to Technikoil, Inc.

TOSCO has retained ownership of its foreign patents and patent applications and foreign rights in its technical information and know-how.

TOSCO has received from Technikoil, Inc. the exclusive world-wide license ("Exclusive License") to use and to sub-license all technology and rights therein held by Technikoil, Inc. A portion of the revenues, if any, from such licensing will be paid over to Technikoil, Inc. pursuant to certain formulae set forth in the agreements. To date no such license has been granted by TOSCO and there is no assurance that any licenses will be granted or that any revenues will be derived therefrom.

THE OIL SHALE CORPORATION (TOSCO) (continued)

TOSCO also licensed the Joint Venture to utilize its technologies in the operations of the semi-works scale oil shale mine, and received in 1964 a payment of $1,500,000 in consideration of such use.

In addition, in connection with the construction of the first and second commercial plant, if any, TOSCO may be paid by other Venture participants in installments and subject to certain contingencies an aggregate of $4,000,000; $2,000,000 is to be paid within thirty days after commitment by the parties of the first facility having a design capacity to process at least 20,000 tons of rock per day and the additional, $2,000,000 is to be paid subject to certain profit conditions relating to the first plant and decisions which may be made with respect to any second plant. The agreement also contains provisions with respect to additional payments which may be made with respect to any second plant. The agreement also contains provisions with respect to additional payments which may be made to TOSCO depending upon production in the second and subsequent plants under circumstances defined in the agreements.

If no commercial oil shale plant is committed by the Joint Venturers by September 18, 1969, TOSCO has the right to terminate certain of the agreements concerning technical property. If TOSCO exercises its right to terminate, the other Venture participants have the right to pay to TOSCO $2,000,000 and to receive from TOSCO a paid-up non-exclusive license for a plant to process not more than 80,000 tons of shale rock per stream day. In addition, upon any such termination, Technikoil, Inc. will assign or reassign certain patents, patent applications and technical information and know-how to TOSCO, retaining other such technical material; and all licenses between the Company and the Venture except the $2,000,000 paid-up license described above will terminate.

TOSCO believes that the technologies and processes developed by it, and currently being applied in the semi-works facilities have certain advantages over prior art.

THE OIL SHALE CORPORATION (TOSCO) (continued)

Among these advantages, in the opinion of Management, are the ability to retort the entire mined product, yields of substantially 100% of the contained hydrocarbons (as determined by the modified Fischer Assay Method), the absence of the products of combustion from the retort effluent, and flexible control of pour point of the raw crude oil product within ranges permitting pipeline transportation and without material loss or degradation of product.

Reserves

TOSCO owns or controls various reserves as set forth in the tabulation below.

PATENTED FEE SHALE RESERVES

Property and Location	Gross Acres	Company's Share of Interest %	Net Attributable to Company's Interest (Acres)
Dow Chemical Company (1), Garfield County, Colorado	8,300	30	2,490
Skyline Oil Company (1), Uintah County, Utah	8,562	30	2,568
Pacific Oil Company (2), Garfield County, Colorado	13,718	30	4,115
Carr Creek Property (3), Garfield County, Colorado	1,292	30	387
Reagle Ranch (3), Rio Blanco County, Colorado	480	30	144
Oldland Ranch (3), Rio Blanco County, Colorado	2,706	32.8	888
Johnson Ranch (3), Rio Blanco Colorado	640	40.1	267
Aitken-Pioneer Property (2), Garfield County, Colorado	640	30	192
Total	36,338		11,041

(1) Option
(2) Owned beneficially
(3) Owned

UNPATENTED OIL SHALE MINING CLAIMS

PROPERTY AND LOCATION	GROSS ACRES	COMPANY'S SHARE OF INTEREST %	NET ATTRIBUTABLE TO COMPANY'S INTEREST (ACRES)
ERTL-DUTTON (1), RIO BLANCO COUNTY, COLORADO	17,612	100	17,612
OHIO CLAIMS (2), GARFIELD COUNTY, COLORADO	7,800	25	1,950
OYLER CLAIMS (1), GARFIELD COUNTY, COLORADO	640	100	640
TOTAL	26,052		20,202

(1) LEASED WITH OPTION TO PURCHASE, OR OTHERWISE CONTROLLED
(2) OWNED

The principal properties in which the Company has a Joint Venture interest are the Dow Property, the Skyline Property and the Pacific Property. The following summaries of option agreements are modified and qualified in their entirety and subject in all respects to the agreements between the parties.

The Dow Property Option

In April, 1964 the Venture acquired in the name of Sohio Petroleum Company an option from the Dow Chemical Company (Dow) to acquire approximately 8,300 acres of oil shale properties in Garfield County, Colorado. The option is for a period of three years with rights of extension upon payment of certain amounts. $1,500,000 was paid upon the execution of the agreement, $2,500,000 was paid since that date and $1,000,000 is to be paid in April, 1967. TOSCO paid $450,000 upon the execution of the agreement $750,000 since that date, and is obligated to pay $300,000 in April, 1967.

The properties may be acquired upon exercise of the option either on an installment payment basis or on a production payment basis, such determination to be made during the first three year period after the execution of the agreement, provided, however, that if the period during which the option may be exercised is extended as provided in the agreement such determination may be made during such extended period.

If the option is exercised and the property is purchased on the installment basis, the purchase price will be $50,000,000 less the amounts of the above payments made, to be paid to Dow in ascending installments over a period of approximately sixteen years from the date of the exercise of the option. Dow's security in the property is to be subordinated to the extent provided in the agreement to any mortgage or deed of trust placed by the purchasers on the property and delivered as security for a construction loan. The three Venture participants will have the right to terminate their obligations of making additional installment payments to Dow by offering the property at public auction. If no sale is made to a third party pursuant to the provisions of the agreement relating to such public auction, the property is to be conveyed to Dow.

If the option is exercised and the property is acquired subject to a production payment, Dow will receive production payments aggregating not more than $63,500,000, less the amount of option payments made, at the time and in the manner specified in the agreement.

In the event the option to purchase the entire property from Dow is not exercised, the parties will have an additional option to purchase a one-third interest in the property upon payment to Dow of a maximum of $11,475,000 subject to adjustments for certain amounts previously paid. As holders of an undivided interest, the parties would be permitted to conduct only certain limited operations on the property without the further agreement of Dow. The purchasers will have the right to terminate their obligations to make additional installment payments with respect to such one-third interest by surrendering all rights in the property to Dow. Such parties will also have the option to purchase the additional two-thirds interest in the Dow property prior to the end of the tenth year after the execution of the agreement, such purchase to be, at the option of the purchasing parties, either on the installment payment basis or the production payment basis, with specified amounts being set forth relating thereto in the agreement.

The agreement further provides that the Venture has the right upon payment of $100,000 to Dow to install facilities on the Dow properties to mine up to 2,000,000 tons of oil shale upon specified payments to Dow which may thereupon be applied against the installment purchase price or initial production payments. The semi-works plant and mine are located on the Dow Property pursuant to this provision and the $100,000 has been paid to Dow.

The Skyline Property Option

Pursuant to agreement of May, 1964 TOSCO, Sohio Petroleum Company and The Cleveland-Cliffs Iron Company own an option to purchase from Skyline Oil Company certain interests in approximately 8,560 acres of land in Uintah County, Utah. TOSCO has a 30% interest in such option.

The purchasers of the option are obligated to make payments aggregating $6,500,000 to Skyline prior to May 28, 1971; between May 1964 and December 31, 1966, an aggregate of $2,750,000 was paid, of which TOSCO paid $825,000. TOSCO is obligated for 30% of the remaining $3,750,000.

In consideration of these payments, Skyline has granted three alternative options, exercisable until May 27, 1971. The purchasers may elect to acquire the property by paying to Skyline a sum equal to $8,750,000 less the total of any payments theretofore made, subject to a retained royalty; or, the purchasers may elect to acquire the property by paying to Skyline a sum equal to $6,500,000 less the total of any payments theretofore made, subject to a retained royalty, provided that they commit themselves to construct and operate an oil shale mine and plant on the property on terms and conditions set forth in the agreement; or, the purchasers may elect to acquire a one-half undivided interest in the property by paying to Skyline a sum equal to $6,500,000 less the total of any payments theretofore made. However, as holders of an undivided interest, the purchasers would be permitted to conduct only certain limited operations on the property without the further agreement of Skyline.

TOSCO and Sohio Petroleum Company are jointly and severally liable to Skyline for all payments to be made under the agreement provided that either of such parties may convey all or part of their interest to other parties without relieving them of their obligations. Pursuant to the Venture agreement the interests in the Skyline option agreement are presently owned in the same proportion as the Venture interests.

The Pacific Property

In 1964 and 1965, the Venture acquired from Pacific Oil Company certain oil shale properties which presently aggregate approximately 13,718 acres. The properties were purchased on an installment basis for an aggregate purchase price (including interest), payable in installments, of approximately $9,230,000. As at December 31, 1966, payments aggregating $8,575,000 had been made, of which TOSCO's share was $2,573,000. The Venture is obligated to make a further payment aggregating $655,000 in 1967, of which TOSCO's share will be approximately $196,000.

Other Properties and Obligations

Pursuant to existing agreements of purchase to which TOSCO is a party relating to the acquisition of shale reserves and related properties, and without giving effect to payments which are to be made in order to acquire ownership of the Dow property and the Skyline property, TOSCO is obligated to make payments in the approximate amounts as follows:

1967	$870,000
1968	$375,000
1969 through 1971	$675,000

In addition, in order to acquire ownership of the Dow property and the Skyline property pursuant to the options referred to under the sub-captions "The Dow Property Option" and "The Skyline Property Option", TOSCO will be required to pay (a) $13,470,000 payable over approximately sixteen years or $17,520,000 payable periodically out of the stated percentages of production from the properties and (b) up to $675,000 payable in the years 1972-1974 subject to retained royalty interests of the optionor.

If sufficient funds are realized from the Subscription Offer and from the proposed transactions with Aquitaine Oil Corporation and Auxirap Corporation of America, TOSCO will use proceeds of such sales of shares for payments against acquisition costs and exercise of option rights as follows:

Property	Date of Payment	Amount
Johnson Ranch	January, 1967	$ 40,000
Dow Property	April, 1967	300,000
Pacific Property	May, 1967	196,000
Skyline Property	May, 1967	225,000
Unpatented mining claims	March, 1967 to Sept., 1967	180,000
Oldland Ranch	November, 1967	108,000
	Total	$1,049,000

There is no assurance that TOSCO will receive sufficient funds to meet such payments.

During the period to December 31, 1978 any party to the Venture agreement which acquires a shale reserve in the states of Colorado, Utah or Wyoming, or any interest in such reserve, must offer to each of the other parties the right to acquire an undivided interest in such reserve of not less than 10% nor more than its percentage interest in the Venture.

TOSCO has applied to the Department of the Interior for a sodium production lease and sodium prospecting permits. TOSCO also has recently acquired various non shale-bearing properties which Management believes would be suitable for community development serving an oil shale industry.

Water

The Venturers have acquired direct pumping rights from the Colorado and White Rivers and options to acquire irrigation rights from those Rivers. They have also entered into a water supply agreement with the Bureau of Reclamation of the Department of the Interior for a supply of water from the Green Mountain Reservoir. The Venturers have entered into option agreements with the Colorado River Water Conservation District providing them the option to participate with the District and others in the construction of four reservoirs and to use a portion of the water stored in them.

TOSCO has also acquired certain pumping and agricultural rights and well permits in connection with its non-Venture reserves. Further expenditure of funds will be required for the continuation and maintenance of the above described water rights and for the acquisition, if any, of further rights.

THE OIL SHALE CORPORATION (TOSCO) (continued)

Stockholders

No person, to the knowledge of the Company, owns of record or beneficially more than 10% of its voting securities.

Acquitaine Oil Corporation and Auxirap Corporation of America each owns 253,000 shares (6.34%) of Common Stock and, under certain circumstances after the expiration of the Subscription Offer may each own up to approximately 35% of the issued and outstanding Common Stock of the Company, this would be equivalent to a lesser percentage of outstanding shares after giving effect to the issuance to others of additional shares presently reserved, as adjusted pursuant to anti-dilution provisions. Southern Natural Gas Company owns all of the 6% Convertible Debentures of the Company due June 30, 1968. Allstate Insurance Company beneficially owns $3,000,000 of 5% Convertible Subordinated Notes of the Company, due 1979, and Mr. Henry Crown and associated groups own beneficially $1,000,000 of such Notes. Mesirow & Company owns warrants to purchase 20,000 shares of Common Stock and Mr. Emby Kaye owns warrants to purchase 12,500 shares.

Pursuant to the provisions of the Promissory Note from the Company to First National City Bank, the Company is restricted from incurring any additional indebtedness for borrowed money (except the indebtedness of $3,500,000 to Aquitaine Oil Corporation) and from declaring any dividends of purchasing or retiring its capital stock or returning any capital to its stockholders or making any distributions to its stockholders.

DENVER RESEARCH INSTITUTE APPOINTS DIRECTOR

Denver Research Institute (DRI) announced, in the spring of 1966, its plans to conduct a series of research studies into the difficult public policy questions surrounding the development of oil shale. In July of 1966 the first report in the DRI series was published, entitled, Regional Economic Impact of a U. S. Oil Shale Industry. A review of this study was presented in the September 1, 1966 issue of this quarterly report, beginning on page 57. DRI has been seeking the services of a leading energy economist to continue the research effort.

Dr. John J. Schanz, Jr., currently Professor of Mineral Economics at the Pennsylvania State University, will join the DRI staff in July 1967 to direct the additional studies in the series.

SINCLAIR ACTIVITIES NOTED

Colorado In-Situ Project Stopped

Sinclair Oil Corporation has recently concluded test operations at its in-situ oil shale experiment. These field test experiments had been underway for the last two years on fee lands located in T1S, R98W in Colorado's Piceance Basin.

Oil Shale Research Division Formed

Sinclair has re-oriented its research activities and has set up an Oil Shale Research Division. Rex T. Ellington, former Director of the Production Research Division, has been named Director of the Oil Shale Research Division. Ellington is also project manager for shale oil development for Sinclair Oil and Gas Company. Ellington and his staff are based at the Tulsa Research Center of the Sinclair Oil and Gas Company.

WATER

USGS STUDIES HYDROLOGY IN PICEANCE BASIN

The Geological Survey has been conducting water studies at the Bureau of Mines Colorado Corehole No. 1, and has additional tests planned for this corehole. Colorado Corehole No. 1 is located in Section 13 of T1N, R98W, 6th P.M. It was drilled late in 1965 and was fully reported in Volume 3, Number 2 (June 1, 1966) of this quarterly report series. The Survey's hydrologic studies at this corehole are of particular importance due to the importance that water may have on the nuclear *in situ* test proposed by the CER Geonuclear consortium.

Specific Tests Planned

Snow conditions permitting, the Survey plans to take its rig back to this corehole the week of February 20, put a packer at the 1800-2000 foot level and pump water from below this level to determine more data concerning the source of water from this hole. The Survey plans tentative to put a pattern of four satellite holes around Colorado Corehole No. 1 at distances of from 500 to 1000 feet out. Each satellite hole would be packed and a series of tests run to determine the extent of water sources in the area.

Water Analysis Available

Water stands normally at 50 feet below the surface in Colorado Corehole No. 1. The water from this corehole is salty. An analysis of water from this hole showed:

Cation	ppm
Na	10,100
K	11
Mg	6

USGS STUDIES HYDROLOGY IN PICEANCE BASIN (Continued)

Anions	ppm
HCO_3	22,000
CO_3	492
Cl	2,750
F	35

Specific Conductance	29,400 mhos
Methane	16%, by volume

ADDITIONAL ADJUDICATIONS NOTED

The last quarterly report included a listing of the adjudications of water rights in Colorado Water District No. 43 which were determined by a decree issued in November of 1966. The last group of claimants was unintentionally omitted and is therefore tabulated on the following pages to complete the list.

ADDITIONAL WATER ADJUDICATIONS -- DECREE OF NOVEMBER 21, 1966
COLORADO STATE WATER DISTRICT NO. 43
DISTRICT COURT FOR RIO BLANCO COUNTY, COLORADO

PRIORITY NUMBER	NAME	APPROPRIATION DATE	PRIORITY DATE	AMOUNT ADJUDICATED	
704	PURDY IRRIGATION PUMP	9/14/61	9/14/61	2.0	CFS
705	FLATTOPS PROJECT	10/31/61	10/31/61	131,034.5 AF (2,444.4 AF DEAD STOR.)	
705-A				75.0	CFS
705-B				60.0	CFS
705-C				254.0	CFS
706	CALIFORNIA OIL COMPANY WATER PIPELINE	11/ 8/61	11/ 8/61	2.5 7.5	CFS CFS
707	MOON LAKE-STALEY MINE PIPELINE AND RESERVOIR	11/14/61	11/14/61	125.0 0.2	CFS CFS
708	CASPER PIPELINE	11/30/61	11/30/61	0.10	CFS
709	C. D. C. PIPELINE	11/30/61	11/30/61	0.20	CFS
710	SHERMAN TAYLOR PIPELINE AND DITCH	1/15/62	1/15/62	5.0	CFS
711	THE BUCKLES DITCH	1/28/62	1/28/62	2.0	CFS
712	CRAWFORD PIPELINE AND DITCH NO. 1	6/ 1/62	6/ 1/62	1.35	CFS
713	PEASE DITCH (THIRD ENLARGEMENT)	6/10/62	6/10/62	11.25	CFS
714	GOVREAU PUMP STATION	6/20/62	6/20/62	400	GPM
715	NEAL PUMP STATION	6/20/62	6/20/62	400	GPM
716	CARSTENS PUMP STATION	6/20/62	6/20/62	400	GPM
717	WHITE LAKES	6/23/62	6/23/62	1.4 0.5 0.5 0.4	CFS CFS CFS CFS
718	C. GENTRY DITCH NO. 1	6/24/62	6/24/62	3.0	CFS

PRIORITY NUMBER	NAME	APPROPRIATION DATE	PRIORITY DATE	AMOUNT ADJUDICATED
719	W. AND P. SPRING	6/25/62	6/25/62	0.5 CFS
720	RANGELY PROJECT	7/ 3/62	7/ 3/62	63,056.3 AF
720-A				(13,110.6 AF DEAD STOR.)
720-B				120.0 CFS
				620.0 CFS
721	DRIEFUSS DITCH (K/K ENLARGEMENT)	7/12/62	7/12/62	1.5 CFS
722	BIG LICK RESERVOIR	7/23/62	7/23/62	481 AF
723	NEW ARCHER WARNER DITCH (POLLARD ENLARGEMENT)	8/11/62	8/11/62	0.79 CFS
724	NEW ARCHER WARNER DITCH (POLLARD ENLARGEMENT)	8/11/62	8/11/62	2.00 CFS
725	REGAS K. HALANDRAS PIPELINE AND DITCH	9/ 6/62	9/ 6/62	2.0 CFS
726	BIG BEAVER CREEK RES.	10/ 8/62	10/ 8/62	7,657.86 AF 2.04 CFS
727	PALMER-CALDWELL DITCH NO. 1	5/23/63	5/23/63	0.78 CFS
728	MARCOTT DITCH (FULTON ENLARGEMENT)	6/17/63	6/17/63	2.0 CFS
729	CRAWFORD PIPELINE NO. 2	6/20/63	6/20/63	5.15 CFS
730	THE SKINNY FISH RES.	7/15/63	7/15/63	300.7 AF
731	MARTIN VILLA RESERVOIR	8/ 6/63	8/ 6/63	.4 466.8 AF
732	K/K DITCH	8/28/63	8/28/63	4.0 CFS
733	THE WHITENER FISH POND AND FEEDER DITCH	9/23/63	9/23/63	2.0 CFS
734	THE WHITENER FISH POND AND FEEDER DITCH	9/23/63	9/23/63	3.065 AF (STORAGE)

PRIORITY NUMBER	NAME	APPROPRIATION DATE	PRIORITY DATE	AMOUNT ADJUDICATED
735	PEASE DITCH (WILSON ENLARGEMENT)	12/ 1/63	12/ 1/63	1.00 CFS
736	THE RYAN GULCH RESERV.	12/15/63	12/15/63	22,635.2 AF
737	THE WHITE RIVER PUMPING PIPELINE	12/15/63	12/15/63	100.0 CFS
738	MOON LAKE-STALEY MINE PIPELINE AND RESERVOIR (ENLARGEMENT)	4/13/64	4/13/64	55.0 CFS 0.1 CFS
739	IMES, REYNOLDS & MCKEIL DITCH (WHEELER ENLARGE.)	5/ 4/64	5/ 4/64	2.05 CFS
740	JOHNSON PUMP CANALS	5/ 5/64	5/ 5/64	5.03 CFS
741	FOURTEEN MILE RESERVOIR	6/24/64	6/24/64	25,988.1 AF
742	FOURTEEN MILE RESERVOIR (FIRST ENLARGEMENT)	6/24/64	6/24/64	60,000.0 AF
743	ALTA VISTA DITCH NO. 1	8/21/64	8/21/64	2.7 CFS
744	ALTA VISTA DITCH NO. 2	8/21/64	8/21/64	1.2 CFS
745	WHITE RIVER-FOURTEEN MILE CREEK PIPELINE	9/12/64	9/12/64	200.0 CFS
746	SOUTH FORK RESERVOIR	9/14/64	9/14/64	85,342.4 AF
747	SOUTH FORK PIPELINE	9/14/64	9/14/64	100.0 CFS
748 749	WINDY BILL SPRING	10/10/64	10/10/64	1.0 CFS 6.5 AF
750	THE WHITE RIVER PIPELINE NO. 2	10/12/64	10/12/64	120.0 CFS

COLORADO SHALE AREA CLAIMS REVIEWED

A number of firms and individuals have received adjudications of water rights in Colorado State Water Districts No. 39 and 43 as a result of the Decrees issued for those districts last November as reported in our last quarterly report. Specific information concerning these adjudications is tabulated following under the headings of the filing companies or individuals. In addition pending applications on file in the State Engineer's office for districts 39, 43, and 70 were examined and are also under the same company headings. The amount of water claimed on pending applications is shown in parentheses following the unadjudicated application description. Maps locating the proposed projects follow the tables. Where the purpose of filing has been stated as specifically relating to oil shale, such purposes are noted. Generally, however, the purpose for filing has been listed as "..for industrial, domestic, municipal, recreational, and irrigation purposes".

PENDING AND ADJUDICATED WATER CLAIMS IN COLORADO OIL SHALE AREA

CLAIMANT	PROJECT NAME	PROJECT DESCRIPTION	ESTIMATED COST	WATER ALLOWED* OR (CLAIMED)	STATE WATER DIST.	MAP. NO.
Humble Oil & Refining Co.	Humble Diversion Forebay and Pumping Plant	Forebay has a dead storage capacity of 6570 AF and is to provide 2000 cfs for direct turbine drive of the Roan Plateau Pumping Pipeline.	$ 3,025,000	8,582 AF	39	1
	Roan Plateau Pumping Pipeline and terminal reservoirs:	56-inch dia. line from Humble Diversion Forebay to terminal reservoirs, a distance of 32.9 miles.	16,650,000	100 cfs	39	1
	Howells Cabin Reservoir	Terminal reservoir having a dead storage of 18.8 AF.	1,590,000	8,114.2 AF	39	1
	Dietz Cabin Reservoir	Terminal reservoir having dead storage capacity of 77.3 AF.	4,270,000	29,967.2 AF	39	1
	Jumps Cabin Reservoir	Terminal reservoir having a dead storage of 41.1 AF.	1,870,000	7,900.9 AF	39	1

*CONDITIONAL ADJUDICATION UNLESS OTHERWISE INDICATED

PENDING AND ADJUDICATED WATER CLAIMS IN COLORADO OIL SHALE AREA

CLAIMANT	PROJECT NAME	PROJECT DESCRIPTION	ESTIMATED COST	WATER ALLOWED* OR (CLAIMED)	STATE WATER DIST.	MAP. NO.
Humble (Cont'd)	White River Pipeline No.2	A 54-inch dia. running 3.43 miles from White River to connection with the South Fork-Piceance Pipeline (Apparently the same as the South Fork Pipeline - see Fourteen Mile Land Co.)	$ 1,850,000	120 cfs	43	1
	White River Pumping Pipeline and:	A 48-inch dia. line runs 11.52 miles from left bank of White River to the Ryan Gulch Reservoir.	3,680,000	100 cfs	43	1
	Ryan Gulch Reservoir	Includes a dead storage of 69.9 AF and is formed by a dam 79 feet in height.	1,230,000	22,635.2 AF	43	1
	Cow Creek Reservoir and:	Reservoir design includes 329.3 AF of dead storage and formed by a 330 ft high dam.	6,500,000	41,024 AF	39	1

*CONDITIONAL ADJUDICATION UNLESS OTHERWISE INDICATED

PENDING AND ADJUDICATED WATER CLAIMS IN COLORADO OIL SHALE AREA

CLAIMANT	PROJECT NAME	PROJECT DESCRIPTION	ESTIMATED COST	WATER ALLOWED* OR (CLAIMED)	STATE WATER DIST.	MAP. NO.
Humble (Cont'd)	Ridge Site Reservoir	Dead storage capacity of 185.7 AF and formed by a 270 ft high dam with a 30 ft maximum dike to close gap on east end.	$ 3,500,000	12,234.2 AF	39	1
		HUMBLE TOTAL	$44,165,000			
Fourteen Mile Land Company	South Fork Reservoir and:	A dam of approximately 270 feet will form the southfork of the White River and tributaries	$ 7,100,000	85,342.4 AF	43	1
	Pipeline	60-inch diameter line running approximately 32 miles.	7,000,000	100 cfs	43	1
	Fourteen Mile Reservoir	To be supplied from tributaries of the Piceance Creek and formed by a dam having a maximum height of 125 ft.	1,050,000	85,988.1 AF	43	1

*CONDITIONAL ADJUDICATION UNLESS OTHERWISE INDICATED

PENDING AND ADJUDICATED WATER CLAIMS IN COLORADO OIL SHALE AREA

CLAIMANT	PROJECT NAME	PROJECT DESCRIPTION	ESTIMATED COST	WATER ALLOWED* OR (CLAIMED)	STATE WATER DIST.	MAP. NO.
Fourteen Mile (Cont'd)	White River-Fourteen Mile Pipeline	Two parallel 48-inch diameter pipes running 61,200 feet from the south bank of the White River.	$ 8,300,000	200 cfs	43	1
		FOURTEEN MILE TOTAL	$23,450,000			
Cities Service Oil Co.	Cities Service Pipeline and Pumping Plant	Headgate located on the right bank of the Colorado River and running 58,951 feet. Single 72 inch diameter line.	$ 2,250,000	(100 cfs)	70	3
Mobil Oil Corporation	Boies Reservoir and:	A dam having a maximum height of 132 feet would form this reservoir which would be supplied directly from Piceance Creek.	$ 1,700,000	31,020.0 AF	43	2
	Piceance Pipe Line	Headgate located on the west bank of Piceance Creek and deliver to the Boies Reservoir, a distance of 7,319 ft in 36-inch diameter pipe.	$ 300,000	50 cfs	43	2

*CONDITIONAL ADJUDICATION UNLESS OTHERWISE INDICATED

PENDING AND ADJUDICATED WATER CLAIMS IN COLORADO OIL SHALE AREA

CLAIMANT	PROJECT NAME	PROJECT DESCRIPTION	ESTIMATED COST	WATER ALLOWED* OR (CLAIMED)	STATE WATER DIST.	MAP. NO.
Mobil Oil (Cont'd)	Piceance Canal	Headgate located on the west bank of Piceance Creek and delivers water through a combination earthwork, concrete conduit and steel pipe, a total distance of 76,409 ft.	$ 980,000	50 cfs	43	2
		MOBIL TOTAL	$ 2,980,000			
Dow Chemical Company	2nd Amended Dow Pumping Plant and Pipeline	72-inch pipeline running 78,015 ft from the right bank of the Colorado River for purposes "related to the production of shale oil and its by-products".	$ 5,100,000	178 cfs	39	4
	Dow Middle Fork Pipeline	36-inch diameter line to run 7560 ft from west bank of the Middle Fork of Parachute Creek for purposes as above claim.	61,000	10 cfs	39	1

*CONDITIONAL ADJUDICATION UNLESS OTHERWISE INDICATED

PENDING AND ADJUDICATED WATER CLAIMS IN COLORADO OIL SHALE AREA

CLAIMANT	PROJECT NAME	PROJECT DESCRIPTION	ESTIMATED COST	WATER ALLOWED* OR (CLAIMED)	STATE WATER DIST.	MAP. NO.
Dow (Cont'd)	Middle Fork Reservoir	Reservoir for purposes as noted in above claims has a maximum dam height of 60 ft and would be supplied from Middle Fork Parachute Creek.	$ 110,000	171,622 AF	39	1
	Dow East Middle Fork Pipe Line	Runs 7780 feet from the northerly bank of the East Middle Fork of Parachute Creek. Pipe is 24-inch diameter and claimed for purposes as above claims.	96,000	20 cfs	39	1
		DOW TOTAL	$ 5,367,000			
Energy Resources Technology Land, Inc. (Tell Ertl)	Ertl Pipeline	Consisting of four headgates and running a total distance of 57.6 miles. The diameter of the major length is 30-inch and there is approximately 62,000 feet of 36" diameter pipe.	$11,386,000	30 cfs	43	5

*CONDITIONAL ADJUDICATION UNLESS OTHERWISE INDICATED

PENDING AND ADJUDICATED WATER CLAIMS IN COLORADO OIL SHALE AREA

CLAIMANT	PROJECT NAME	PROJECT DESCRIPTION	ESTIMATED COST	WATER ALLOWED* OR (CLAIMED)	STATE WATER DIST.	MAP. NO.
Ertl (Cont'd)	Ertl Reservoir	Supplied from Parachute Creek via Daisy Ditch and a lateral pipeline	$ 750,000	(165.03 AF)	39	3
		ERTL TOTAL	$12,136,000			
Getty Oil Company	Getty Reservoir Number One	Reservoir having a maximum dam height of 105 feet and supplied from the Colorado River through the pumping pipeline of the Pacific Western Oil Corporation for "purposes used in connection with the production of shale oil and its products".	$ 525,000	(2,543.9 AF)	39&70	6A
	Getty Reservoir Number Two	Same as Getty Reservoir Number One except having a maximum dam height of 225 feet.	4,500,000	(20,670.2 AF)	39&70	6B

*CONDITIONAL ADJUDICATION UNLESS OTHERWISE INDICATED

PENDING AND ADJUDICATED WATER CLAIMS IN COLORADO OIL SHALE AREA

CLAIMANT	PROJECT NAME	PROJECT DESCRIPTION	ESTIMATED COST	WATER ALLOWED* OR (CLAIMED)	STATE WATER DIST.	MAP. NO.
Getty Oil (Cont'd)	Pumping Pipeline of the Pacific Western Oil Corporation	Headgate located on the north bank of the Colorado River and runs approximately 20 miles to supply above two reservoirs through 42-inch diameter pipe for the same purposes as reservoirs.	$ 2,740,000	56 cfs	39	3
	Klein Reservoir	Supplied from East Elk Creek and having a maximum dam height of 235 ft.	2,800,000	(29,532 AF)	39	1
	East Elk-Roan Plateau Pipeline	Headgate is the outlet works of the Klien Reservoir and consists of 36-inch diameter pipe running a total distance of 51.4 miles	4,400,000	(30 cfs)	39	1
		GETTY TOTAL	$14,965,000			

*CONDITIONAL ADJUDICATION UNLESS OTHERWISE INDICATED

PENDING AND ADJUDICATED WATER CLAIMS IN COLORADO OIL SHALE AREA

CLAIMANT	PROJECT NAME	PROJECT DESCRIPTION	ESTIMATED COST	WATER ALLOWED* OR (CLAIMED)	STATE WATER DIST.	MAP. NO.
Sinclair Oil and Gas Co.	Sinclair Oil and Gas Co. Pumping Plant and Pipeline	A 36-inch diameter pipeline having its intake located on the northerly bank of the Colorado River and running a total distance of 43,940 ft. Purpose includes "all other uses necessary and related to the production of shale oil and its by-products".	$ 645,000	33 cfs	39	1
Sohio Petroleum Company	Deer Park Gulch Pumping Pipeline and:	Headgate located at pumping plant on the right bank of the Colorado River and consists of 18 miles of 60-inch diameter pipe and four stage pumping plants.	$ 9,000,000	150 cfs	70	7
	Conn Creek Feeder Pipeline and:	Diverts from the right bank of Conn Creek and runs 6810 feet. Line to be 36-inch diameter pipe and feeds the Deer Park Gulch Pumping Pipeline.	59,000	50 cfs	70	7

*CONDITIONAL ADJUDICATION UNLESS OTHERWISE INDICATED

PENDING AND ADJUDICATED WATER CLAIMS IN COLORADO OIL SHALE AREA

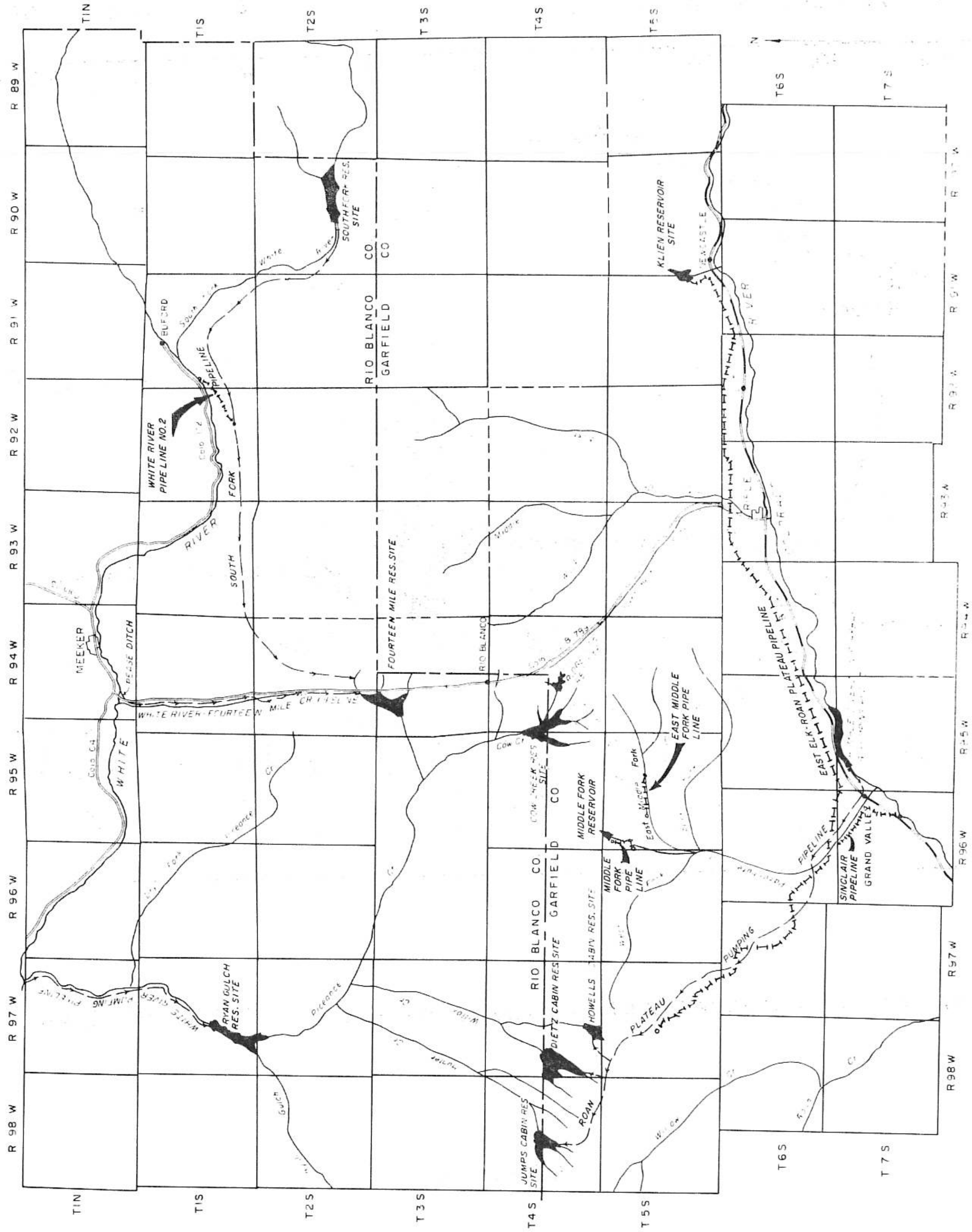
CLAIMANT	PROJECT NAME	PROJECT DESCRIPTION	ESTIMATED COST	WATER ALLOWED* OR (CLAIMED)	STATE WATER DIST.	MAP. NO.
Sohio (Cont'd)	Clear Creek Feeder Pipeline	A 36" diameter line running 7890 ft from east bank of Clear Creek to Deer Park Gulch Pumping Pipeline	$ 66,000	50 cfs	70	7
		SOHIO TOTAL	$ 9,125,000			
The Texas Company (Producing Department)	CANNON-(VAN CLEAVE) Ditch Enlargement	Headgate located on the East Bank of Brush Creek and running 4205 feet. THIS PROJECT WAS CONSTRUCTED.	$ 650,000	6.76 cfs (unconditional)	70	3
The Oil Shale Corporation (TOSCO)	The Oil Shale Corporation Pipeline and Pumping Plant	Headgate located on the right bank of the Colorado River and consists of 146,530 ft of 56-inch diameter pipe for purposes including "uses necessary and related to the production of oil shale and its byproducts".	$ 3,100,000	100 cfs	39	3

*CONDITIONAL ADJUDICATION UNLESS OTHERWISE INDICATED

PENDING AND ADJUDICATED WATER CLAIMS IN COLORADO OIL SHALE AREA

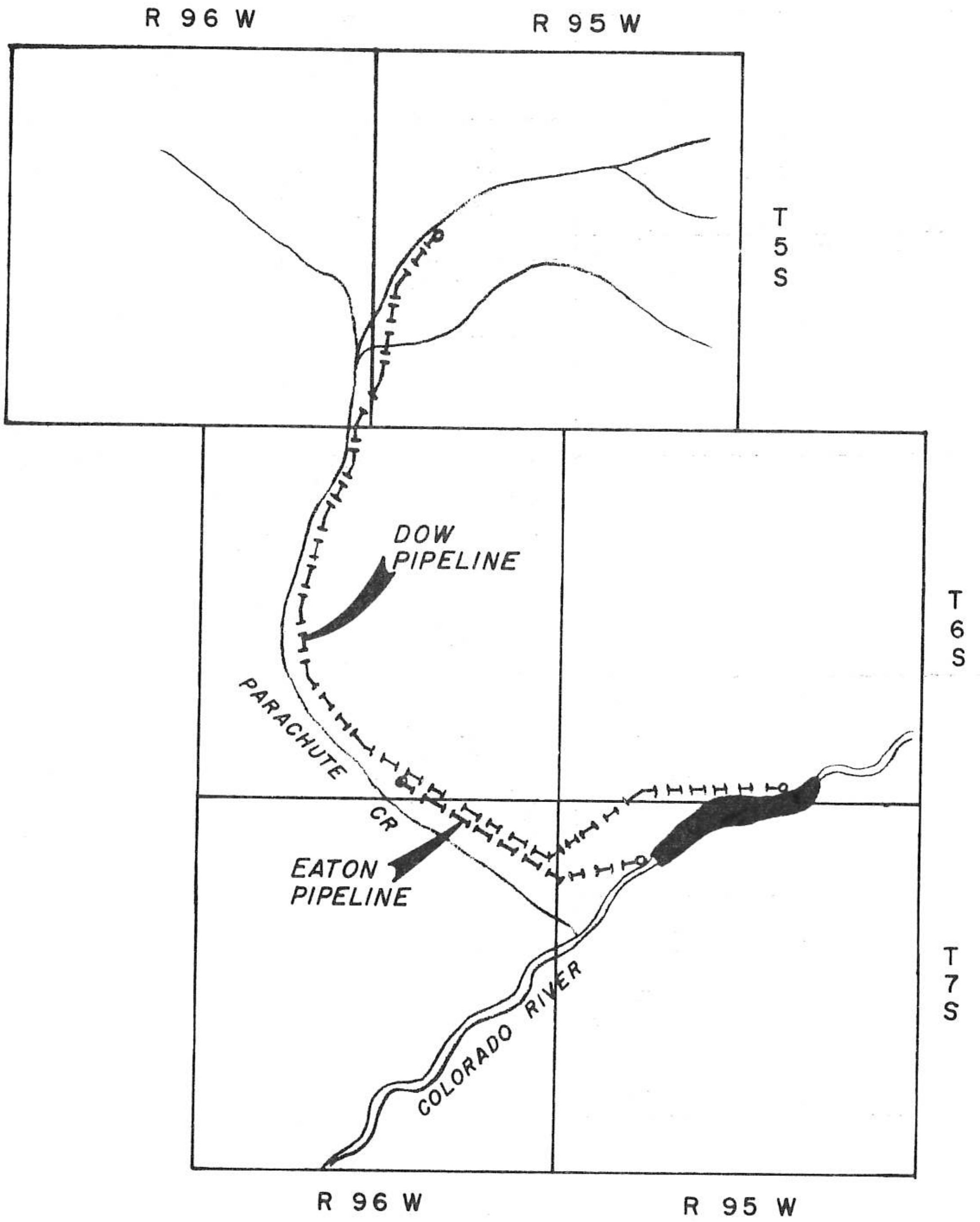
CLAIMANT	PROJECT NAME	PROJECT DESCRIPTION	ESTIMATED COST	WATER ALLOWED* OR (CLAIMED)	STATE WATER DIST.	MAP. NO.
Charles P. Casteel, Erven T. Larson, and Neil S. Mincer	Shale Pumps and Pipeline	Pumps located on the northerly bank of the Colorado River and delivers through 10-inch diameter pipe a distance of 2268.1 feet.	$ 20,000	11.11 cfs	39	3
Clarence H. Dragert	Dragert Pumping Plant and Pipeline	Intake located on the northerly bank of the Colorado River and runs a distance of 52,057.38 ft. The line is 54-inches in diameter and has a stated purpose which includes "uses necessary and related to the production of shale oil and its by-products".	$ 1,520,000	94 cfs	39	3
Rea L. Eaton	Eaton Pumping Plant and Pipeline	54-inch diameter line having its intake on the west bank of the Colorado River and running 68,905 feet.	$ 1,750,000	100 cfs	39	4

*CONDITIONAL ADJUDICATION UNLESS OTHERWISE INDICATED



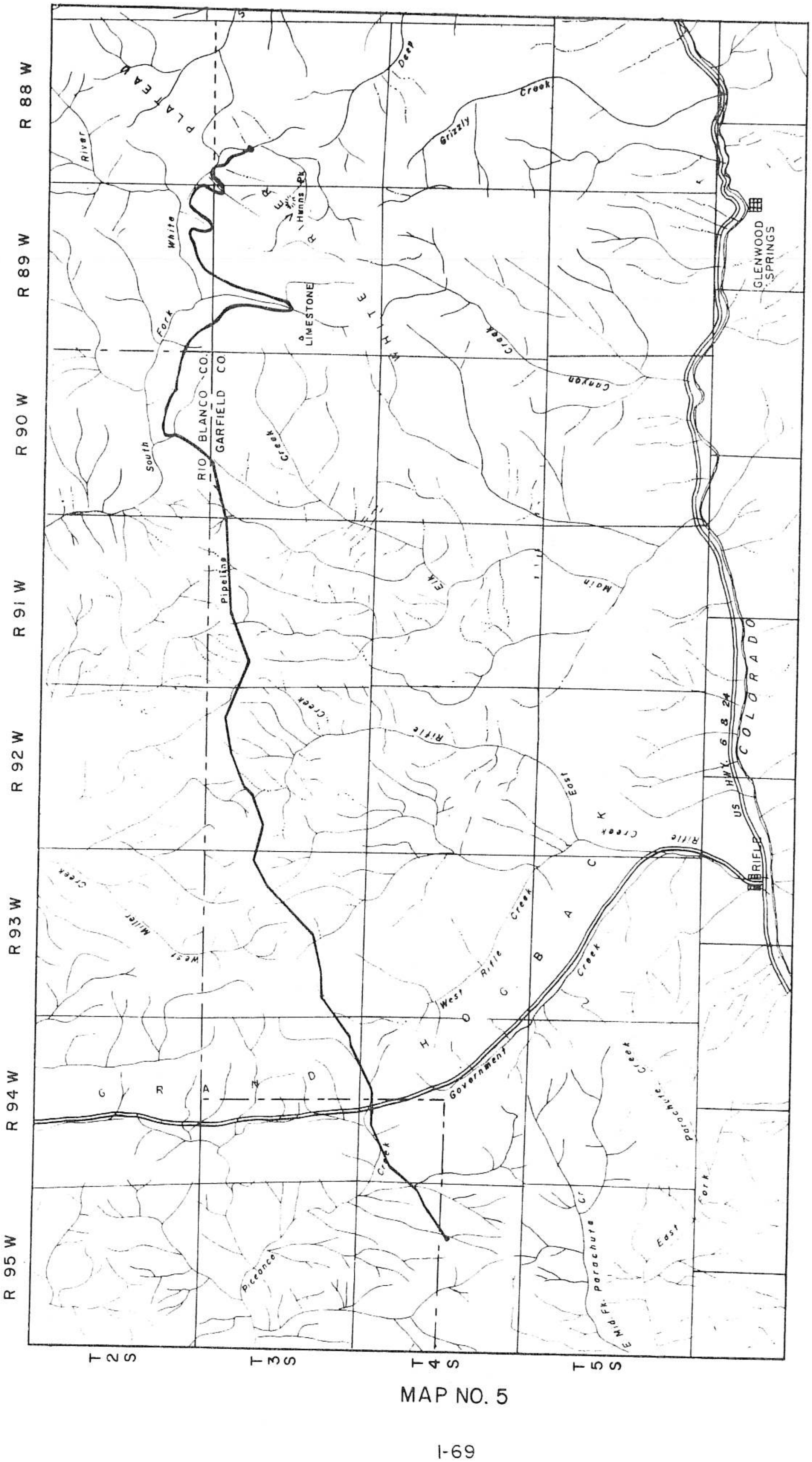
LOCATION OF PROPOSED WATER PROJECTS IN COLORADO OIL SHALE AREA

MAP NO. I



LOCATION OF PROPOSED WATER PROJECTS
IN COLORADO OIL SHALE AREA

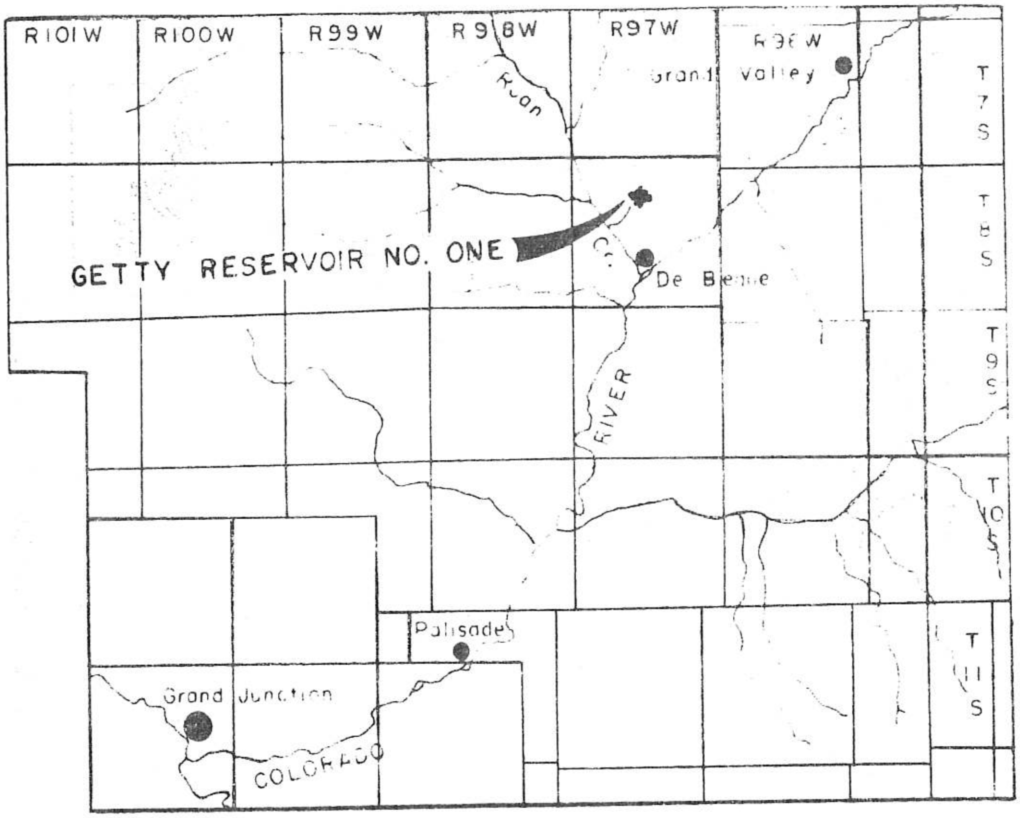
MAP NO. 4



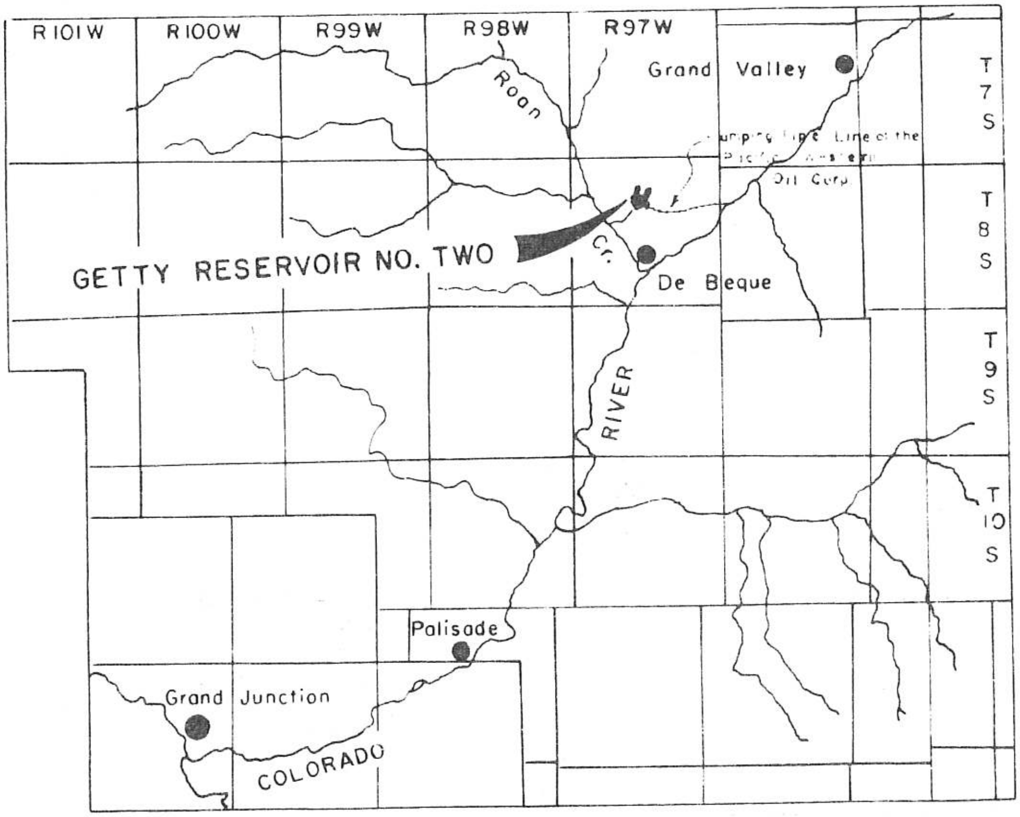
LOCATION OF PROPOSED WATER PROJECTS IN COLORADO OIL SHALE AREA

MAP NO. 5

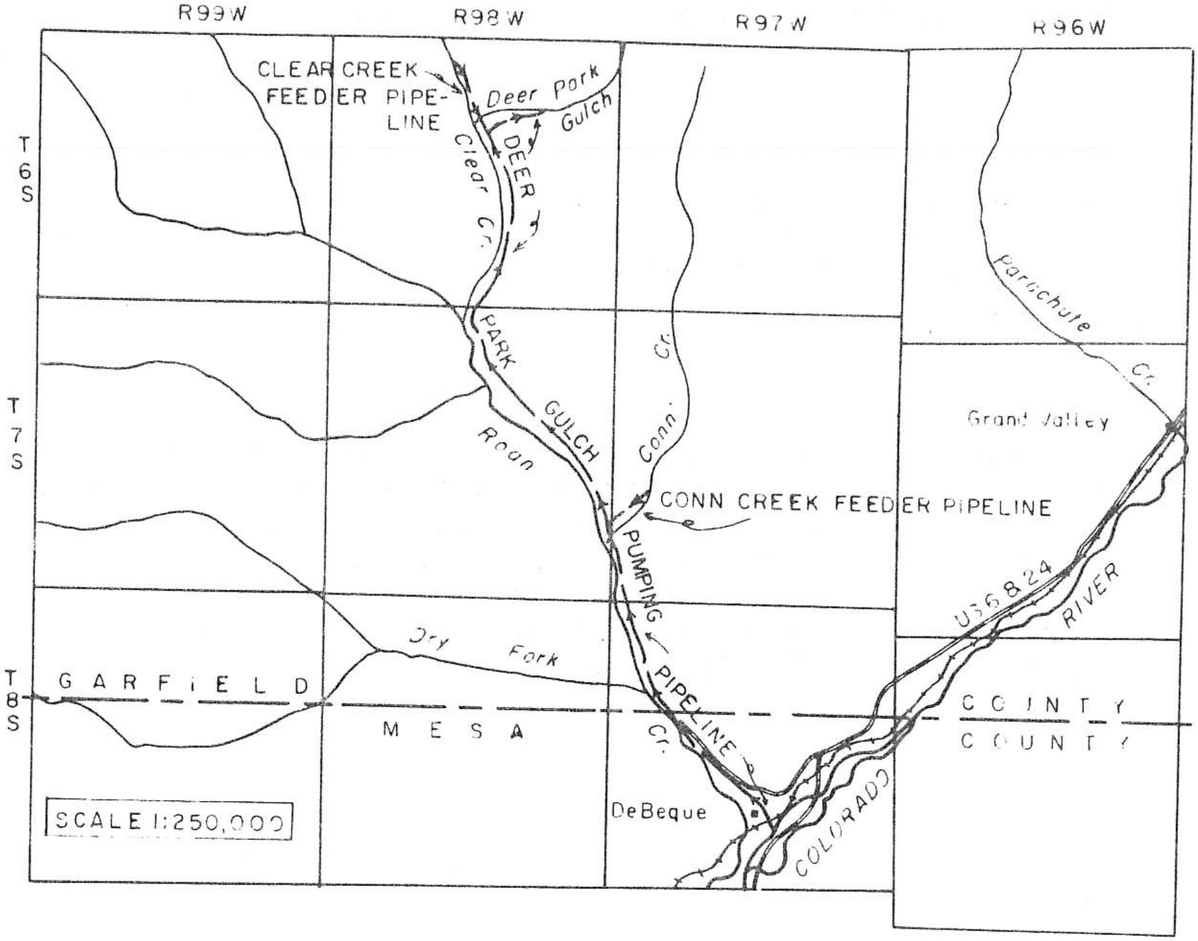
LOCATION OF PROPOSED WATER PROJECTS IN COLORADO OIL SHALE AREA



MAP NO. 6A



MAP NO. 6B



LOCATION OF PROPOSED WATER PROJECTS IN COLORADO OIL SHALE AREA

MAP NO. 7

OTHER

SENATE BILL WOULD CREATE DEPARTMENT OF NATURAL RESOURCES

The task of utilizing and protecting the Nation's land, water, forest and wildlife resources is one task and should be under the jurisdiction of one Department, according to Senator Frank Moss of Utah. Moss is introducing Senate Bill S. 886, to be known as the Natural Resources Act of 1967, which would redesignate the Department of the Interior as the Department of Natural Resources.

Moss' Bill would place all responsibility for land, water, etc., in one Department, eliminating such problems as we now have with land (for example) wherein the BLM in Interior administers part of our land and the Forest Service in Agriculture administers the remainder, with both departments managing for multiple use, resulting in duplication of efforts and constantly overlapping jurisdictions.

FEDERAL WITHDRAWAL OF OIL SHALE LAND AFFECTS SODA LEASING

Your attention is invited to the Special Feature section of this report for a discussion of the withdrawal of oil shale lands in Colorado, Utah and Wyoming from all forms of mineral entry.

WYOMING LAW TO PERMIT SODA MINING ON "ALTERNATE" SECTIONS

A group of eleven companies interested in mining deposits of trona ($Na_2CO_3 \cdot NaHCO_3$) on alternate sections of land is supporting Wyoming House Bill 208. This Bill passed the House vote and is now in the Senate for action. The Union Pacific RR and the Federal Government own alternate sections of land in a 40-mile strip running across Sweetwater County, Wyoming. House Bill 208 would

WYOMING LAW TO PERMIT SODA MINING ON "ALTERNATE" SECTIONS

permit condemnation proceedings to provide an underground right-of-way for access purposes during underground mining of trona in the checkerboard area. The Union Pacific RR opposes the Bill.

U. S. ENERGY CONSUMPTION EXPECTED TO DOUBLE IN TWENTY YEARS

Ebasco Services, Incorporated, utility consultants, reported in their News Release dated December 16, 1966, that energy consumption per capita in the United States in 1965 was 278 million Btu. This was based on a population of 194.6 million and a total energy consumption of 54.031 quadrillion (10^{15}) Btu. The report is summarized in the following table in which the U. S. energy consumption projected by Ebasco is in quadrillion Btu annually.

	1965		1975		1985	
	Btu x 10^{15}	Pct.	Btu x 10^{15}	Pct.	Btu x 10^{15}	Pct.
Bituminous Coal and Lignite	12.03	22.3	15.20	20.5	22.10	22.1
Anthracite Coal	.33	.6	.35	.5	.35	.3
Crude Oil	19.19	35.5	23.85	32.2	28.85	28.9
Petroleum Products Net Imports	2.37	4.4	3.00	4.1	3.50	3.5
Natural Gas, dry	16.15	29.9	22.80	30.8	28.00	28.0
Natural Gas, Liquids	1.87	3.4	2.60	3.5	3.40	3.4
Water Power	2.05	3.8	2.70	3.7	3.40	3.4
Nuclear Power	.04	.1	3.50	4.7	10.40	10.4
	54.03	100.0	74.00	100.0	100.00	100.0

PIPELINING SHALE OIL EXAMINED

The oil shale reserves of the United States being somewhat remote from major refining and marketing areas require that any exploitation program give consideration to means for transporting synthetic crude derived from oil shale from the producing area to the marketing areas. The obvious magnitude of the problem immediately suggests an investigation of the existing pipeline network adjacent to or accessible from the Piceance Basin Area. any required extensions of the existing network, and an examination of present tariffs.

Existing Pipelines Adjacent to Piceance Basin

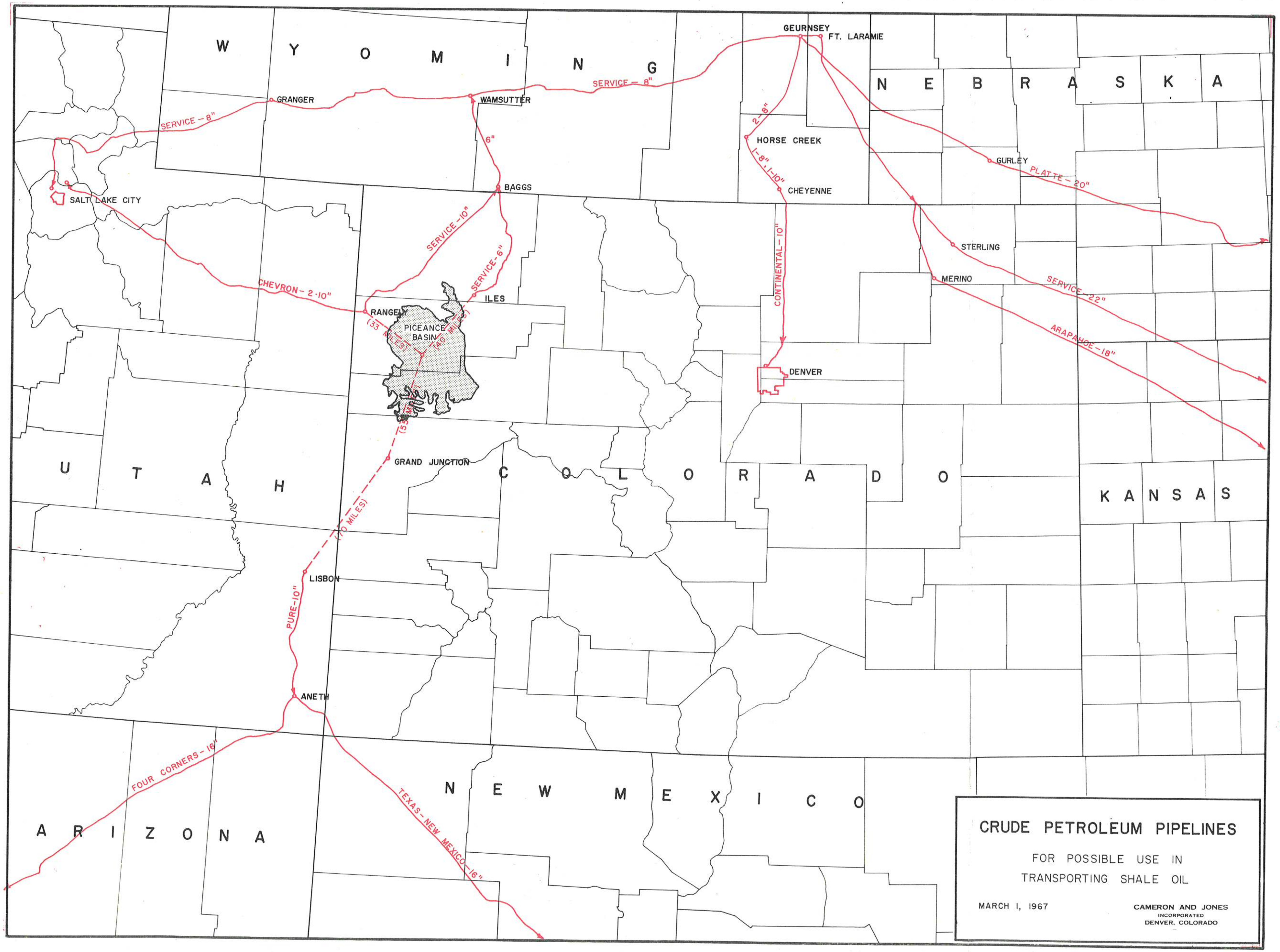
The existing pipeline network serving areas adjacent to the major U. S. reserves of oil shale are indicated as solid red lines on the foldout map which follows this page.

Additional Pipelines Required

The "dotted-line" extensions of the Pure (10"), Chevron (2-10") and Service (6") lines appearing on the map represent a possible existing means of providing pipeline transportation for shale oil to the West Coast, Gulf, and Midwest areas. The center of the Piceance Basin would appear to be a reasonable site for an origin station for shale oil.

Current Pipeline Rates

Examples of I.C.C. pipeline tariffs on crude petroleum from selected stations near the Piceance Basin area to typical market destinations are provided in the following table and include capacity data on the routes. Each pipeline tariff contains specific rules, regulations and definitions concerning minimum quantities, mixtures, storage, qualities of crude, etc. These will not be considered here, assuming that a good-quality synthetic crude oil in sufficient quantities will be available and acceptable for transporting in the existing lines.



CRUDE PETROLEUM PIPELINES

FOR POSSIBLE USE IN
TRANSPORTING SHALE OIL

MARCH 1, 1967

CAMERON AND JONES
INCORPORATED
DENVER, COLORADO

CURRENT PIPELINE RATES AND CAPACITIES

From	To	Via Pipeline(s)	Excess/Total Capacity (Barrels/Day)	ICC Tarrif Rates (for Total Run in ¢ per Barrel)
Rangely, Colo.	Wood River, Ill.	Service (6")* Service (8")	None/10,000 5,000/25,000	32.0
Rangely, Colo.	Whiting, Indiana	Service (6")* Service (8")	None/10,000 5,000/25,000	35.0
Rangely, Colo.	Sugar Creek, Mo.	Service (6")* Service (8")	None/10,000 5,000/25,000	22.0
Rangely, Colo.	Salt Lake Station, Utah	Chevron	8,000/70,000	12.0
Iles, Colo.	Wood River, Ill.	Service (6")* Service (8")	None/10,000 5,000/25,000	32.0
Iles, Colo.	Whiting, Indiana	Service (6")* Service (8")	None/10,000 5,000,25,000	35.0
Iles, Colo.	Sugar Creek, Mo.	Service (6")* Service (8")	None/10,000	22.0

* Limiting Capacity of Route

CURRENT PIPELINE RATES AND CAPACITIES (continued)

From	To	Via Pipeline(s)	Excess/Total Capacity (Barrels/Day)	ICC Tarrif Rates (for Total Run in ¢ per Barrel)
Iles, Colo.	Denver, Colorado	Service (6")*	None/10,000	26.0
		Service (8")	5,000/25,000	
		Continental (2-8")	6,000/54,000	
		Continental (10"&8")	6,000/54,000	
		Continental (10")**	None/36,000	
Libson, Colo.	Houston, Texas	Pure	25,000/40,000	64-1/2
		Texas-New Mexico	Unavailable	
	Los Angeles, California	Pure *	25,000/40,000	62-1/2
		Four-Corners	30,000/110,000	
	Ponca City, Oklahoma	Pure	25,000/40,000	67-1/2
		Texas-New Mexico	Unavailable	

* Limiting Capacity of Route

** Modifications to increase capacity of this line are being considered.

II

TAR SANDS

BITUMINOUS SANDS

UTAH LEGISLATURE STUDIES COMBINED LEASE FORM

State Senator Omar Bunnell, as chief sponsor, in cooperation with Senators Reed Bullen and Charles Welch, Jr., introduced a Bill (S.B. 77) to the legislature in late January to amend certain sections of the Utah Code and Laws of Utah relative to mineral and grazing leases. Basically the proposed legislation would alter existing regulations in three categories as follows:

First: there would be extensive revision of the Land Board's Mineral Leasing authority which would permit the Land Board to adopt a form of lease that would grant the lessee the right to produce all hydrocarbons, except oil shale and coal. Oil shale and coal would be leased separately. The Land Board has conducted extensive public hearings and is convinced it would be in the best interest of the State of Utah to issue a single form of hydrocarbon lease of State-owned lands. No provision in the proposed bill would make the changes in law retroactive; however, the rental minimum of $0.50 per acre per annum and the minimum 10-year lease period now in effect on oil and gas leases would apply to the new lease form.

Second: At present, the Land Board cannot grant grazing leases covering more than 25,000 acres of State-owned lands to a single individual. Several range operations in the state have grown in size, and this 25,000 acre restriction is no longer realistic. The proposed legislation would remove this restriction.

Third: Heretofore, the Legislature has never appropriated funds to the Land Board for range improvement and conservation programs, although the Board has responsibility in these areas. The legislation would authorize the Land Board to expend monies from the 20% maintenance fund for range improvement and conservation programs with approval of the Board of Examiners.

UTAH LEGISLATURE STUDIES COMBINED LEASE FORM (Continued)

A copy of S.B. 77, as introduced, is presented in the appendix of this report beginning on page A-31.

BITUMINOUS SAND CORPORATION'S HOLDINGS EXAMINED.

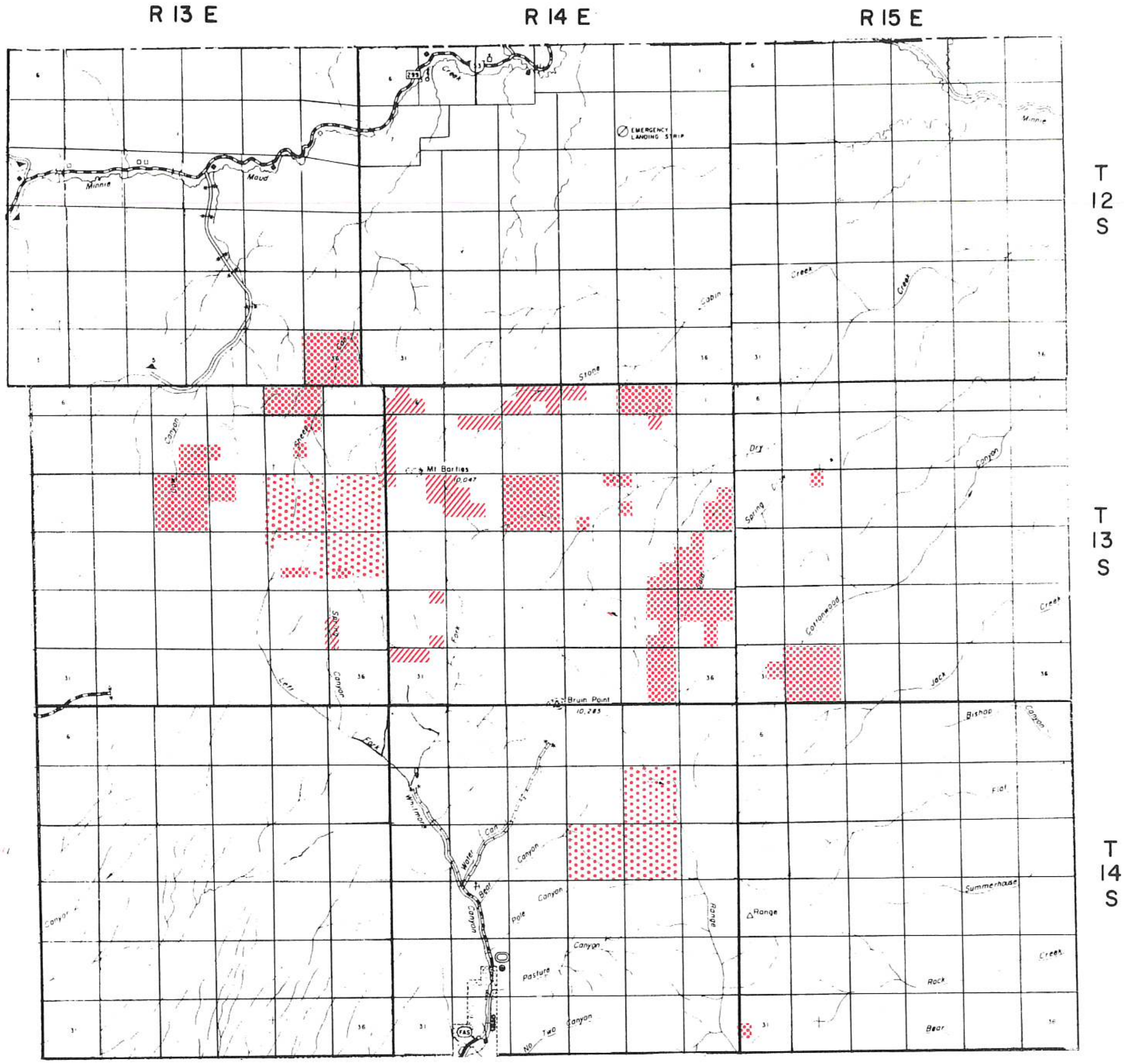
The Bituminous Sand Corporation of America, a Utah corporation having a stated business of "mineral resources development and investment" has been acquiring bituminous sand leases in the state since 1962 through its officers. Daniel H. Meyer and John C. Osmond, as president and vice-president respectively, have combined and individual bituminous sands leases in the Asphalt Ridge, P.R. Springs and Sunnyside Areas. These leases include areas of Federal, State, and fee lands and are shown so coded on the maps following this page. The Federal leases were, in turn, assigned by the officers to the company with an overriding royalty of 2-1/2% reserved for each officer. Some of the leases obtained were on land already under oil and gas leases held by Shell Oil Company.

Federal Lease Conflict Clarified

The company has received an opinion from Thomas J. Cavanaugh, Interior Department Associate Solicitor for Public Lands to the effect that in situ processing of bituminous sand could be accomplished under a bituminous sands lease. No specific clarification on a state level is known. (See previous article on Utah single hydrocarbons lease form).

Water Application Filed

The Company has filed application to appropriate 12 second-feet of water from the Green River for the Sunnyside leases. According to the application, the water will be used for purposes including "refining and steam flooding".

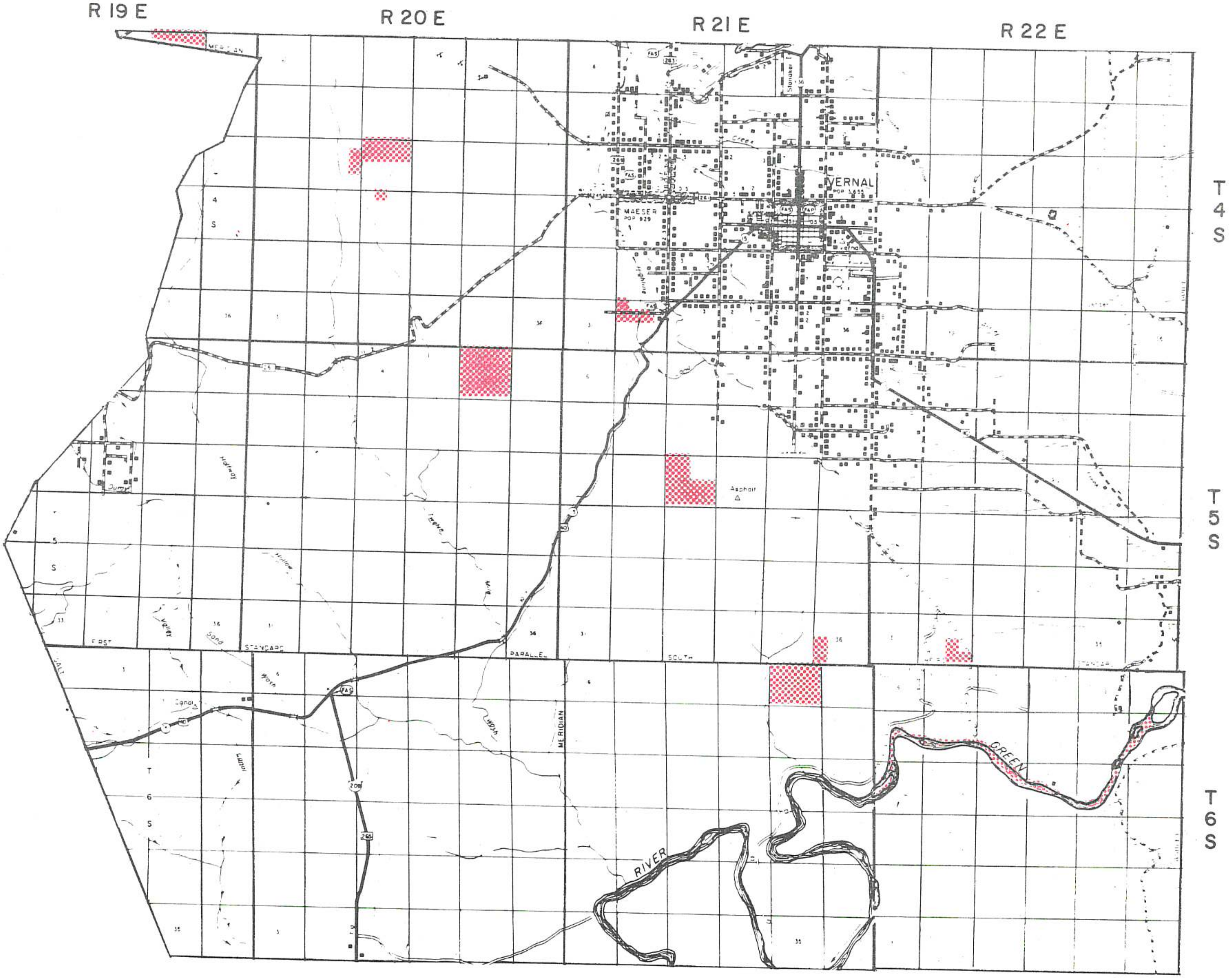


BITUMINOUS SAND CORPORATION of AMERICA
Sunnyside Area Holdings

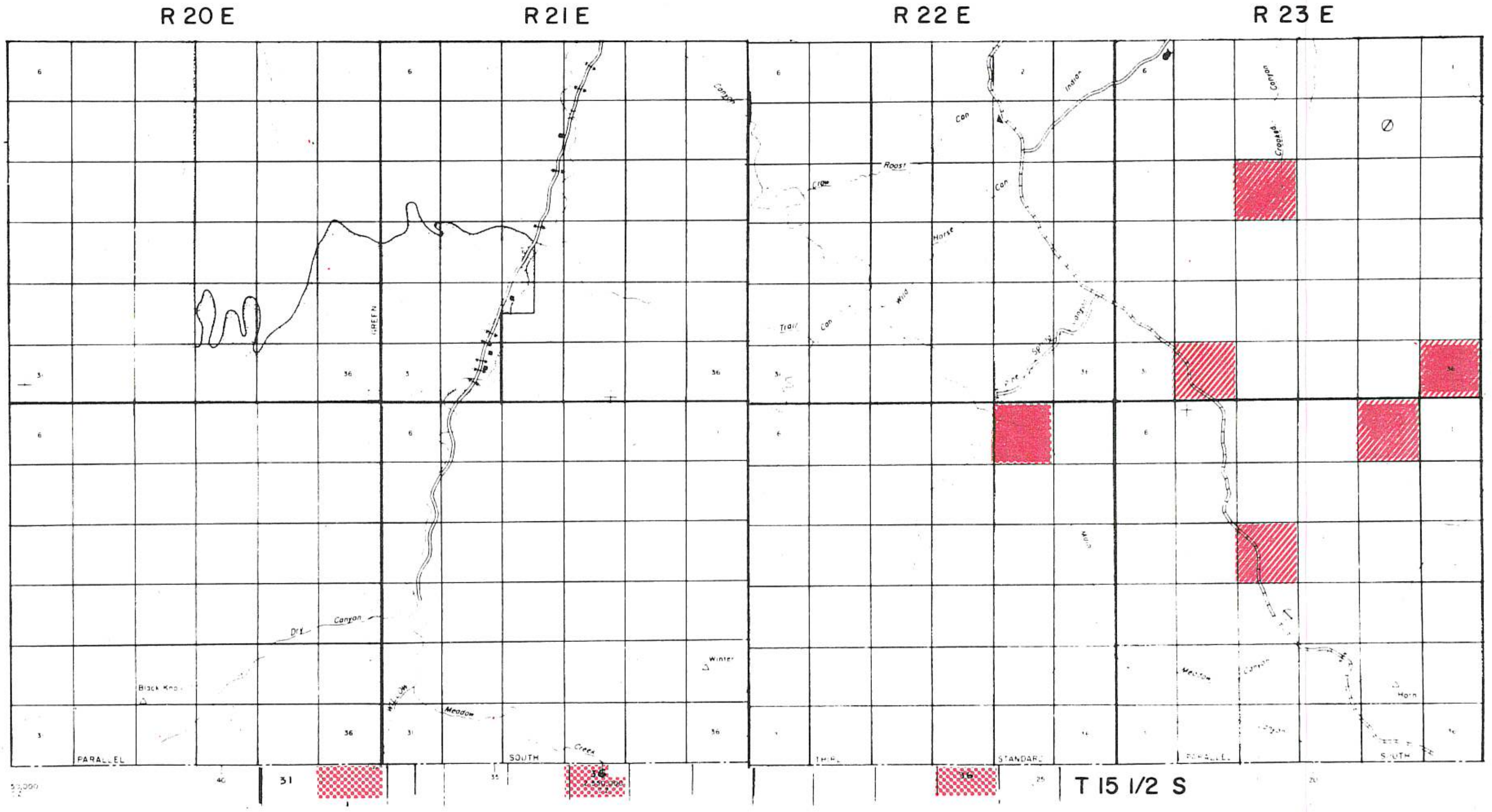
Fee Lands ▨

State Lands ▩

Federal Lands ░



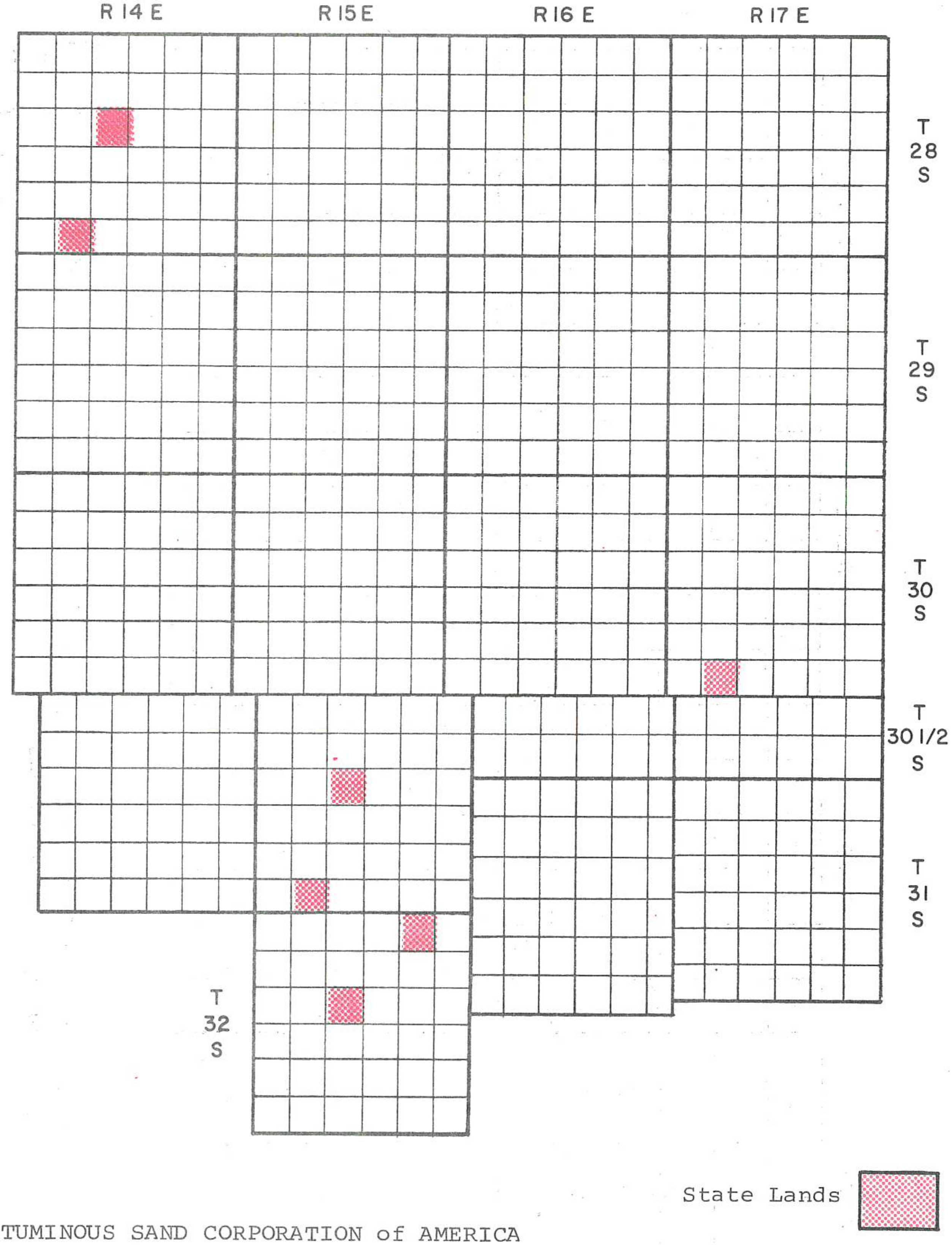
BITUMINOUS SAND CORPORATION of AMERICA
Asphalt Ridge Area Holdings



BITUMINOUS SAND CORPORATION of AMERICA
P. R. Springs Area Holdings

🟥 Fee Lands

▨ State Lands



BITUMINOUS SAND CORPORATION of AMERICA
Southwestern Utah Holdings

BITUMINOUS SAND CORPORATION'S HOLDINGS EXAMINED (Continued)

No Testing Planned

Osmond has stated that the company has no intentions to proceed with any experimental thermal projects until:

1. Possible conflict over oil and gas and bituminous sands leases has been fully clarified.
2. The State makes known its ultimate intentions on the selling of leases on the newly acquired lands from the Federal government in the Asphalt Ridge area.
3. Results of experimental work now being done by Signal, Pan Am, and others is more apparent.

LITTLE CHANGE NOTED IN ALBERTA LEASES

There were no new bituminous sands leases or prospecting permits filed in Alberta Canada during this reporting period. The only change in ownership was an apparent assignment of nearly 50,000 acres by Atlantic Richfield to a group of companies including Atlantic. This change is noted in red over the permit and lease listing on the following page which is the same listing that appeared in the last report.

TAR SANDS LEASES AND PROSPECTING PERMITS IN THE ATHABASCA TAR SANDS AREA OF ALBERTA, CANADA

TAR SAND LEASES

COMPANY NAME	LEASE NUMBER	ACREAGE
AQUITAINE COMPANY OF CANADA, LTD.	39	49,742
ARROWHEAD EXPLORATION COMPANY, LTD.	23	36,937
ATLANTIC RICHFIELD COMPANY	~~40~~	~~22,054~~ *
	54	49,495
	55	26,002
	56	23,377
	57	49,451
	58	36,042
	59	45,414
	60	31,250
	61	26,641
	63	43,562
	65	49,467
	66	49,419
	70	46,802
	71	36,492
	72	41,016
ATLANTIC RICHFIELD COMPANY AND IMPERIAL OIL LTD. AND CITIES SERVICE ATHABASCA LTD.	79	27,205
	81	41,954
BAILEY SELBURN OIL & GAS LTD.	42	21,729
BAILEY SELBURN OIL & GAS LTD., AND WHITEHALL CANADIAN OILS LTD.	19	18,758
	20	13,657
GREAT PLAINS PETROLEUM LTD., AND COLORADO OIL & GAS CORPORATION	25	49,964
CAN-AMERA OIL SANDS DEVELOPMENT LTD.	5	5,874
	43	49,734

COMPANY NAME	LEASE NUMBER	ACREAGE
CANADIAN FINA OIL LTD.	6	6,440
	7	2,866
	8	1,393
	9	5,801
	11	2,483
	12	4,174
	33	22,700
	34	9,129
	82	48,489
CANADIAN HUSKY OIL LTD. AND HUSKY OIL COMPANY	35	49,904
CANEX GAS LTD.	15	2,094
CITIES SERVICE ATHABASCA, INC. AND ATLANTIC RICHFIELD COMPANY AND IMPERIAL OIL LTD. AND ROYALITE OIL COMPANY LTD., C/O SYNCRUDE CANADA, LTD.	17	49,788
	22	49,591
	29	49,722
	31	49,870
	32	11,365
	41	18,401
	78	36,086
COLORADO OIL AND GAS CORPORATION (SEE GREAT PLAINS PETROLEUM LTD.)		
FRENCH PETROLEUM COMPANY OF CANADA LTD.	50	32,324
GREAT CANADIAN OIL SANDS LTD.	14	4,177
HOME OIL COMPANY LTD.	30	37,715
HUSKY OIL COMPANY	SEE CANADIAN HUSKY OIL LTD.	
IMPERIAL OIL LTD.	SEE CITIES SERVICE ATHABASCA, INC.	

*INFORMATION GIVEN IN RED REPRESENTS CHANGES SINCE THE LAST QUARTERLY REPORT.

COMPANY NAME	LEASE NUMBER	ACREAGE
IMPERIAL OIL LIMITED AND CITIES SERVICE ATHABASCA, INC. ATLANTIC RICHFIELD COMPANY ROYALITE OIL COMPANY c/o ATLANTIC RICHFIELD COMPANY 650 GUINNESS HOUSE 727 - SEVENTH AVENUE SOUTH WEST CALGARY, ALBERTA	40	22,054*
MIC MAC OILS LTD.	18	49,969
MOBIL OIL OF CANADA, LTD.	16	5,824
	21	2,584
	36	12,156
	37	49,751
	38	26,339
PAN AMERICAN PETROLEUM CORPORATION	73	49,931
	76	49,837
REGENT REFINING LTD.	67	25,969
	68	46,154
	69	23,377
ROYALITE OIL CO., LTD.	(SEE CITIES SERVICE ATHABASCA)	
SHELL CANADA LTD.	13	49,872
	26	23,506
	28	40,642
	42-A	16,209
	45	49,731
	53	49,419
SINCLAIR CANADA OIL COMPANY	52	35,109
	74	23,353
	75	25,945

*INFORMATION GIVEN IN RED REPRESENTS CHANGES SINCE THE LAST QUARTERLY REPORT

COMPANY NAME	LEASE NUMBER	ACREAGE
SUN OIL COMPANY, LTD.	10	11,227
	27	49,994
	83	624
	84	49,379
	85	49,419
	86*	3,898
SUPERTEST PETROLEUM CORPORATION	24	49,941
SYNCRUDE CANADA LTD.	(SEE CITIES SERVICE ATHABASCA)	
TENNECO OIL COMPANY	87	49,427
TEXACO EXPLORATION COMPANY	44	49,775
	46	49,751
	47	49,735
	48	49,763
	49	49,727
	51	49,503
WHITEHALL CANADIAN OIL LTD.	(SEE BAILEY SELBURN OIL)	
WOOD OIL COMPANY	77	6,792

TAR SANDS PROSPECTING PERMITS

COMPANY NAME	PERMIT NO.	ACREAGE
AMERADA PETROLEUM CORP.	127	35,258
	128	28,734
	129	11,918

* FORMERLY LEASE NO. 4, RENEWED AS LEASE NO. 86

OTHER

GCOS REQUESTS PRODUCTION INCREASE

Prior to the September - 1967 start up of their tar sands processing plant in Alberta Province, Great Canadian Oil Sands has requested an increase of their production quota from 45,000 B/D to 65,000 B/D. The Premiers office has had the request under study for some time, but a reply from the Oil and Gas Conservation Board indicates that there has been no change in the production quota or change in the applications of Syncrude Canada, Ltd. or Shell Canada Ltd. as of February 8 of this year.

III

COAL and LIGNITE

NATIONAL DEVELOPMENTS

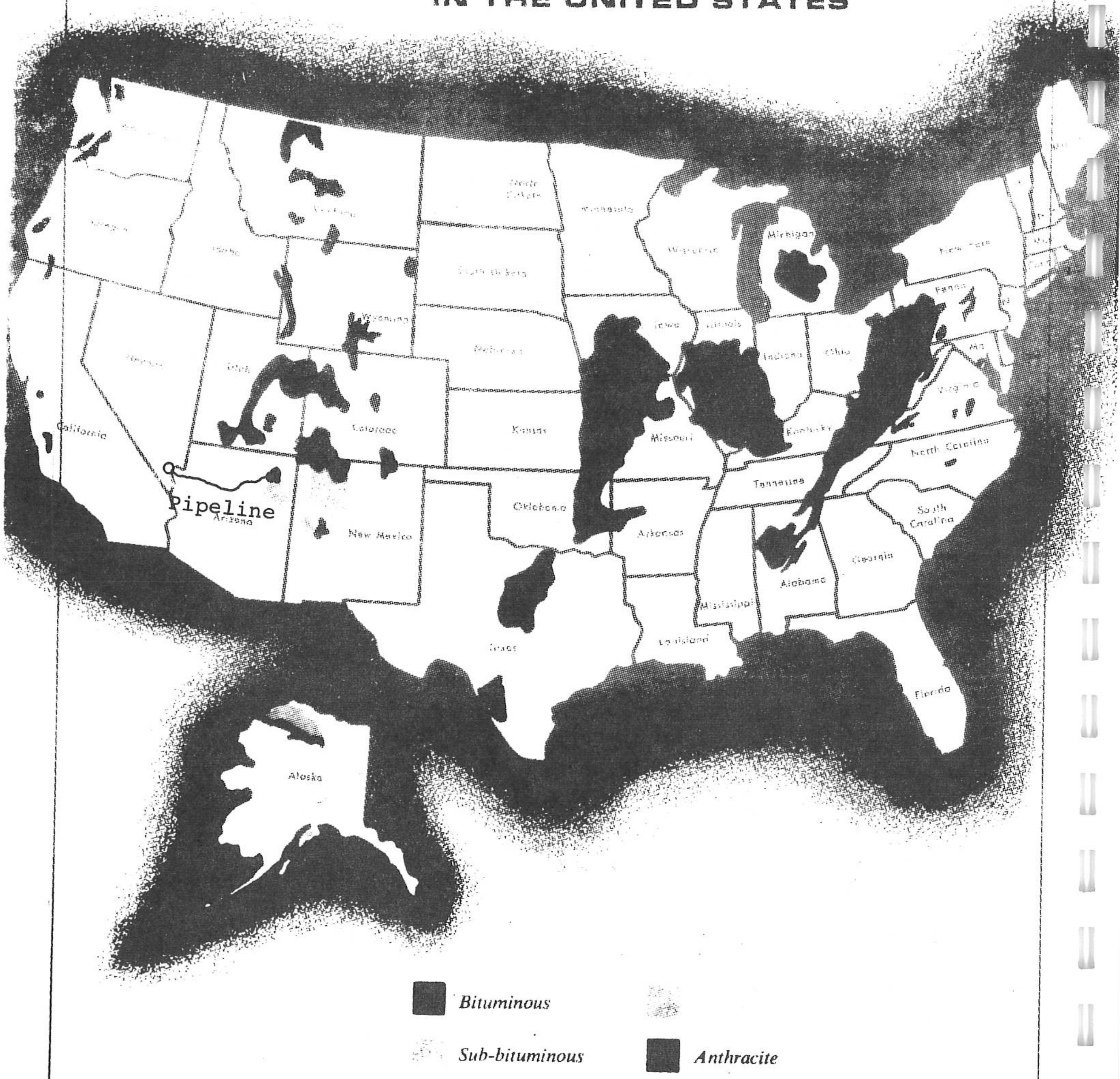
This report is primarily concerned with coal as it may compete with oil shale for the liquid fuels market. Anything which may change the availability, economics, technology or politics of coal may effect this competition, and significant events in these fields are included in the report.

Transportation of coal took a step ahead with the announcement of a coal slurry pipeline to transport coal from an area in northeastern Arizona to a power plant to be located in southern Nevada, a distance of 275 miles. The absorption of independent coal mining companies into a variety of larger organizations is becoming more common and this time Island Creek Coal Company joins the growing list. Another trend, one which threatens coal's largest market, toward large nuclear power plants, continues but the enthusiasm has diminished. Developments in technology of coal conversion come mainly from work contracted from the Office of Coal Research and these are summarized below.

SLURRY PIPELINE TO TRANSPORT COAL TO NEVADA

Peabody Coal Company and Black Mesa Pipeline, Inc., the latter a wholly owned subsidiary of Southern Pacific Pipe Lines, Inc., announced on January 9, 1967, that they had entered into an agreement under which Black Mesa will construct and operate a coal slurry pipeline. For geographical location, see map on the reverse side of this sheet. The coal will be mined from properties owned by the Navajo and Hopi Indian Tribes on the Black Mesa in northeastern Arizona. Peabody, through their wholly owned subsidiary, Sentry Royalty Co., leased the coal properties and Peabody will mine the coal. The coal will probably be strip-mined, washed and crushed to size at the mine. The coal will be mixed with about its own weight of water and will be pumped through a pipeline approximately 16 inches in diameter and 275 miles

COAL AREAS
IN THE UNITED STATES



Courtesy N.C.A.

Pipeline location by C&J

SLURRY PIPELINE TO TRANSPORT COAL TO NEVADA (Continued)

long. When the coal reaches its destination, the Mohave Power Plant in southern Nevada, it will be dewatered and pulverized before burning under the boilers. The plant will be complete about 1971 and will have a capacity of 1510 megawatts. To keep it supplied with fuel, the pipeline will have to transport about 12,000 tons of coal per day. It will be the largest and the longest pipeline of its type and perhaps the only one in operation in the United States when it is put into service.

Consolidation Coal Company built a pipeline about 10 inches in diameter and 108 miles long and transported coal slurry from Cadiz, Ohio to Cleveland, Ohio. The line delivered about 1.4 million tons of coal per year and during its operation handled over 5 million tons of coal. It was shut down about five years ago when competing railroads reduced their tariff.

A coal slurry pipeline received serious consideration toward the end of 1961, but it never was built. It would have run from southwestern Pennsylvania to New Jersey and New York, but its developers did not have rights of eminent domain and could not acquire the necessary right of way. As proposed by Texas Eastern Transmission Company and Consolidation Coal Co. it would have been a 20- to 30- inch pipeline costing about $100 million. A year later the same two companies proposed a similar pipeline from the coal fields of Utah to southern California. It, too, was not built.

There have been those who doubt that the Black Mesa pipeline will be built. However, plans are being formulated, right of way is being obtained and survey parties are working. We believe this pipeline will become a reality. Furthermore, the Research Foundation of the Colorado School of Mines is investigating the grinding characteristics of the Black Mesa coal for one of the interested parties. This would be a prerequisite for the preparation of a suitable pipeline slurry.

ANOTHER INDEPENDENT COAL COMPANY TALKS MERGER

The merger of Pittsburg & Midway Coal Co. into Gulf Oil Corp. is a five-year-old story. The merger of Consolidation Coal Co. into Continental Oil Co. was completed last September. We have no recent comment on the acquisition of United Electric Coal Companies by stock purchase by General Dynamics Corp.

Kennecott Copper Co. and Peabody Coal Co. are making progress on their plans to merge and now expect the merger to be complete late this year. Peabody will probably become a division of Kennecott. The transaction will have a value of over $460 million. The companies each reported that both their last quarter earnings and their earnings for the year of 1966 exceeded the prior year's values. For the year, Kennecott earnings were about $125 million, up about 23 percent, and Peabody reported record earnings of $26.3, up almost 17 percent over 1965.

Island Creek Coal Company became the latest independent involved in a potential merger. In mid-January, 1967, Island Creek's chairman, J. L. Hamilton and Cleveland Cliffs Iron Company president H. Stuart Harrison issued a joint statement concerning the possible merger of the two companies. The directors of both companies agreed to make joint studies of the possible merger. These would be followed by lengthy negotiations.

Cleveland Cliffs mines iron ore in the United States and in foreign countries. It is experienced in mining, up-grading and pelletizing iron ore. Of added interest, it is the mining partner in the Colony Development Company oil shale venture.

Island Creek Coal Company produces about 8 million tons of coal per year from mines in West Virginia, Virginia, and Kentucky.

NUCLEAR POWER EXPANSION SLOWS

Six months ago the announcements of proposed new nuclear power plants seemed to come one right after the other. Twice as much nuclear capacity was proposed in 1966 than the total for all the prior years.

Much of the nuclear excitement was started by the announcement of very low cost for both nuclear fuel and the nuclear power plant for generating 2,200 megawatts by the Tennessee Valley Authority. TVA is reported to have awarded a contract to General Electric in February, 1967 for a turbogenerator for its 1,100 megawatt station. The contract was written with an escape clause that would allow TVA to select a different generating capacity, "if studies now under way indicate a coal-burning installation or another project would offer a more economical source." TVA is reported to have said that it has several possible coal-burning sites under study and has options on equipment for a coal burning plant.

NEW CONTRACTS BY THE OFFICE OF COAL RESEARCH CITED

High Temperature (Plasma) Treatment of Coal

Stanford Research Institute, Menlo Park, California, was awarded a contract on January 19, 1967, by the OCR. The $176,000 contract is for a one-year study to determine the technical feasibility of converting coal to organic solvents and highly volatile liquid fuel products. The idea is to cause carbon particles suspended in a stream of gas to pass through a high-temperature zone called a plasma. At these exceedingly high temperatures and because of the arrangement of the high-temperature equipment, very high heat transfer rates should occur and perhaps result in high capacity with efficient utilization of electric power.

Previous work on this subject was performed at the University of Utah and was reported in the December 1, 1966 Quarterly Report, Vol. 3, No. 4, on page 119.

NEW CONTRACTS BY THE OFFICE OF COAL RESEARCH (Continued)

Relatively high power input caused doubts about commercialization of the process presented.

The Bureau of Mines reported the results of small scale plasma reactions in Report of Investigations RI 6829, Reaction of Coal in Argon and Argon-Hydrogen Plasmas, 1966. Related work is described in Bureau of Mines Report of Investigations RI 6868, Comparison of Products from High-Temperature Irradiation and Carbonization of Coal, 1966. The latter is a report on laser irradiation of coal.

STATUS OF PROJECTS OF THE OFFICE OF COAL RESEARCH REVIEWED

Project "Gasoline". The pilot plant at Cresap, West Virginia is undergoing shakedown tests and should be fully operational at the end of March.

Project "COED". A report has been prepared by the contractor, FMC Corp., on the experimental work carried out in their COED process development unit during 1966. At this writing, it has not yet become available for inspection. George Fumich, Jr., Director of OCR, announced in a speech on November 15, 1966, that a large pilot plant would be constructed to further test the COED carbonization process. The cost of construction and operation of the pilot plant will be about $6 million over a period of 4 1/2 years.

Project "H-Coal". A report, "Commercial Process Evaluation of H-Coal Hydrogenation Process", was released by OCR on February 20, 1967.

Pipeline Gas From Coal, Two-Stage Super-Pressure. Bituminous Coal Research received an amendment to its contract with OCR on October 31, 1966. BCR will receive an additional $1.0 million to build and operate a 100 pound per hour coal gasifier and operate it to determine factors involved in scale-up. The term of the amended contract is from December 20, 1966 to March 20, 1968.

CO_2-Acceptor Process. Consolidation Coal's contract for this process has three months to run. A pilot plant designed to feed one to two tons per hour of lignite will be built at Rapid City, South Dakota. The plant is currently being designed and will cost about $2.5 million. Construction should start late in 1967.

Hydrogasification. The Institute of Gas Technology has a contract with OCR for four more months. They are designing a large pilot plant which should be under construction late in 1967.

De-Ashing of Coal. Pittsburg & Midway Coal Company was awarded a contract by OCR for a five-year period starting in November, 1966. The contract was for $7.6 MM and calls for building a two-ton-per-hour pilot plant in Tacoma, Washington. Bids have been received, but it is not known if a sub-contractor has been selected to complete the design and erect the plant.

REPORTS ISSUED BY OFFICE OF COAL RESEARCH NOTED

Review and Evaluation of Project Fuel Cell

A report with the above title was issued by OCR on December 12, 1966. It was prepared under contract to the OCR by the Jackson & Moreland Division of United Engineering and Constructors, Inc. The report analyzes the work done by Westinghouse Electric Corp. under its contract to OCR to develop a fuel cell fueled by coal. Their report was prepared in accordance with an agreement signed with OCR on August 26, 1966, so it represents a three-month effort.

It has been apparent for some time that several persons on the staff of OCR have been very enthusiastic about the coal-fired fuel cell and the Jackson & Moorland report also exudes confidence and recommends to OCR that the project be continued. Their economic study shows that the overall coal-to-power plant is 60 percent thermally efficient and that power can be generated at 345,000 volts, ac, at 2.991 mills per kilowatt-hour in a 1,000 megawatt plant. George Fumich, Jr., OCR director, told us recently that the process appeared promising but there were still many problems to be resolved.

The basic principles involved are:

a. Gasification of coal utilizing hot gases from the fuel cell.
b. Purification of the gases to essentially pure hydrogen and carbon monoxide.
c. Admitting this gas as fuel to the negative electrode of the fuel cell.
d. Admitting air to the positive electrode.

Oxidation of the hydrogen to water and of the carbon monoxide to carbon dioxide produces a flow of direct current through the fuel cell. The apparent breakthrough in the work so far has been the development of thin-film batteries of fuel cells mounted on half-inch tubes and connected in series, electrically. Although fairly exotic materials of construction have been used, the costs of the batteries has been reduced and the overall efficiency, coal to power, has been increased to an indicated 60 percent.

Several advantages of this type of power generating plant over the conventional plant are probable. First, as has been mentioned, the thermal efficiency is about 60 percent compared to under 40 percent for a conventional plant. Second, the fuel cell plant would require much less cooling water, an increasingly important consideration. Third, the sulfur present in the coal fuel would be removed after gasification and would not be emitted to the atmosphere. There should be very little or no atmospheric pollution from a fuel cell plant. Fourth, there should be a good possibility of recovering sulfur, and potentially other chemicals, for sale. This was not considered in the Jackson & Moorland estimate.

The report is available only at certain repository libraries around the country.

The Potential Market for Midwestern and Alaskan Coal and Lignite

A report with the above title was prepared by Robert R. Nathan, Inc. and was announced on November 11, 1966, by the OCR. The report presents the background for coal in the designated areas and proceeds to predict the potential in the year 1980. It was not possible to predict Alaska's potential at this time, but the midwestern potential in 1980 is 6 1/2 times the tonnage of coal consumed in that area in 1964. See pages A-23 to A-26 in the Appendix for reproductions of some of the more important information presented in the Nathan report.

The Midwest study is Part II of a comprehensive study of the market potential for western coal and completes the contract awarded to the Nathan firm by OCR in October, 1964. Part I, The Potential Market for Far Western Coal and Lignite, was published in January, 1966.

The largest increase in coal consumption in the Midwestern States (Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, Kansas, Arkansas, Oklahoma, Texas and Louisiana) between 1964 and 1980 will be for electric power generation. About 6.4 million tons of coal were used for this purpose in 1964 and in 1980 about 49.8 million tons will be burned. The report recommends that industry should: 1. study the opportunities for coal-derived electric generation identified in the report; 2. examine the possibilities of Oklahoma metallurgical grade coal; 3. consider the added long-term investments in coal production; 4. study the economics in all steps from mining through transport and utilization; and, 5. cooperate with Government and private research organizations. The report recommends the following actions by the Government: 1. increase the support for research into conventional and new types of electric generation; 2. improve the Government reports on U. S. coal resources by adopting geological criteria related to economic factors, make more private resource data public, and perform more exploration; and, 3. change existing policy to encourage exploration and development of coal resources.

Copies of Part II of the Nathan Report are currently available for individual ownership. They may be ordered from the Office of Coal Research, Department of the Interior, Washington, D. C., 20240. Check for $5.00 per copy should be made payable to "Interior, Office of Secretary".

Supplemental Report on Char Oil Energy Development

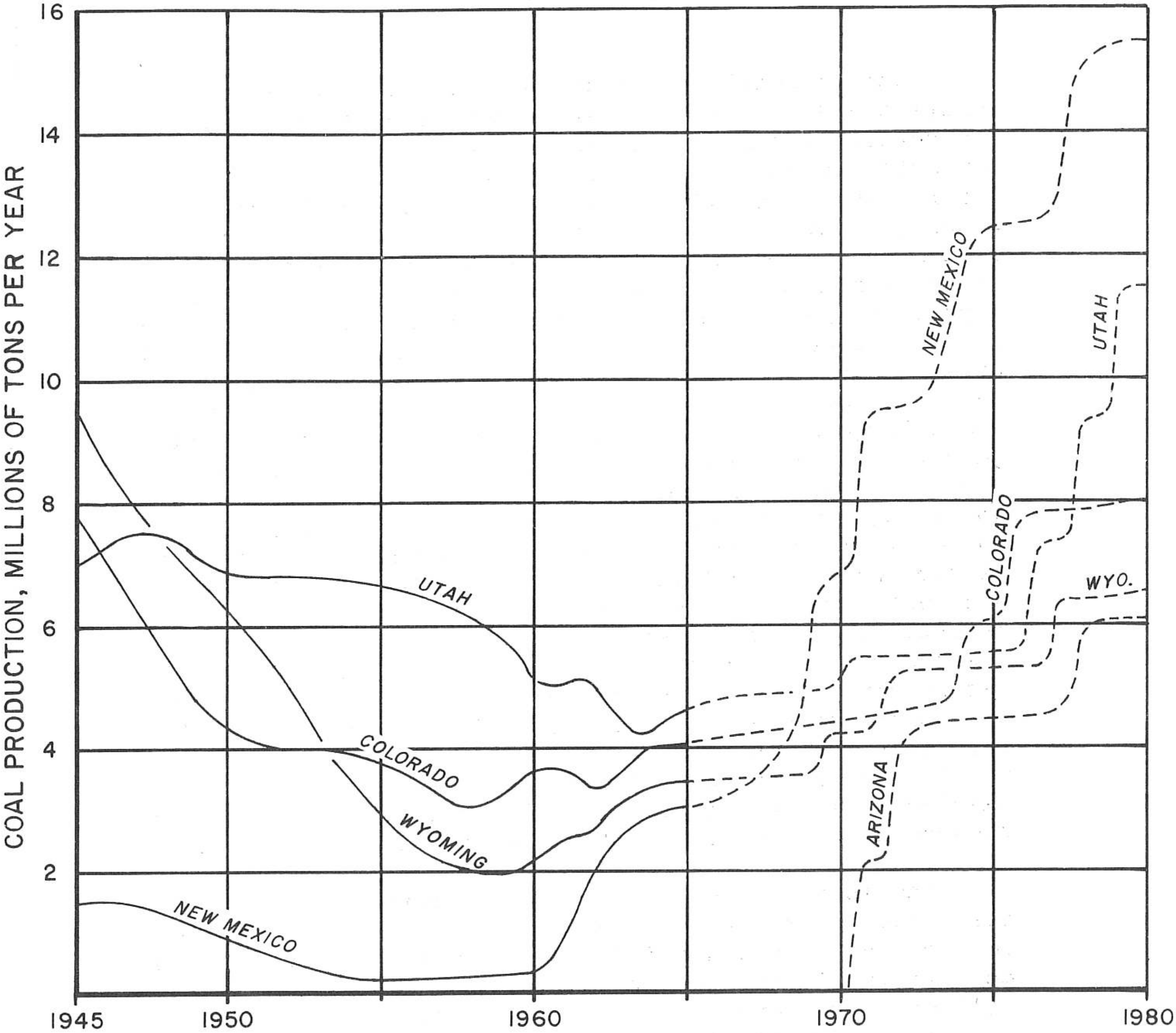
A report with the above title was released by the OCR on February 14, 1967. It was prepared by the FMC Corporation who performed the work covered by the report under contract to the OCR. The work was done from January to October of 1966 and supplements work done on the coal carbonization process development unit prior to 1966. This prior work was reported in a two-volume set dated December 9, 1965.

The supplement is available at selected repository libraries. It can be ordered from OCR for $7.50.

WESTERN DEVELOPMENTS

Until recently the western coal states were Utah, Colorado and Wyoming. Other western states had small production of coal for local use, but since the railroads converted to diesel fuel after World War II, coal usage has fallen in all of the western states and electric power generation remains the principal market for the coal mined. The slump from 1945 to 1960 is very evident on the graph, Coal Production in Western States, which appears on page 3-12. Of great significance is the projected increase in production in these states as planned power generation plants come on stream. These step-wise increases are already with us in the case of New Mexico where large mines were opened about five years ago and just three new mines put that state into the category of a coal producing state. Arizona will join the others in about three years when the coal-slurry pipeline, discussed earlier under National Developments, is put into service hauling coal from the Black Mesa. The state of Washington will become a coal producing state with the recently announced power plant to be built by Pacific Power and Light Company. It will be built near Centralia, Washington, and a nearby open-pit coal mine will supply the approximately 4 million tons of coal per year to fuel it. This will increase coal production in the state about 60 times and will occur about 1973. However, Washington is not included on the graph of coal production because it is remote from the area of prime interest.

The enormous increase in coal production which is currently under way, and which will accelerate as time goes by, has touched off quite a scramble for control of coal fields in the western states. In this report, we will cover the changes in coal land status in Utah, Wyoming, Colorado and New Mexico. In each issue one of these states is chosen for a study in some depth. This time Colorado has been selected and a number of pertinent coal data have been presented along with a map showing the changes during 1966 in the coal land situation,



COAL PRODUCTION IN WESTERN STATES. PREDICTED VALUES BASED ON FUTURE ELECTRIC POWER PLANTS DUE ON STREAM. C&J, MARCH 1967 particularly on the public domain. The map is on the foldout page which follows this page.

Following the discussion of the coal lands in the western states is a review of how coal is being used in the western states.

COLORADO COAL STATISTICS PRESENTED

Coal Production for Colorado in 1966 Exceeds 5 Million Tons

The Colorado State Coal Mine Inspection Department of the Division of Natural Resources released the following coal production data for the year of 1966.

County	Coal Production, Tons	Number of Mines
Delta	19,349	5
Fremont	01,502	18
Garfield	6,094	3
Gunnison	648,149	6
Huerfano	36,588	5
La Plata	21,719	7
Las Animas	847,932	12
Mesa	109,585	7
Moffat	194,142	2
Montrose	74,826	1
Pitkin	718,203	6
Rio Blanco	5,331	2
Routt	1,557,708	7
Weld	685,400	5
Total	5,226,548	86

COLORADO COAL STATISTICS (Continued)

Coal Leases and Exploration Permits in the Last Three Months on Public Lands in Colorado

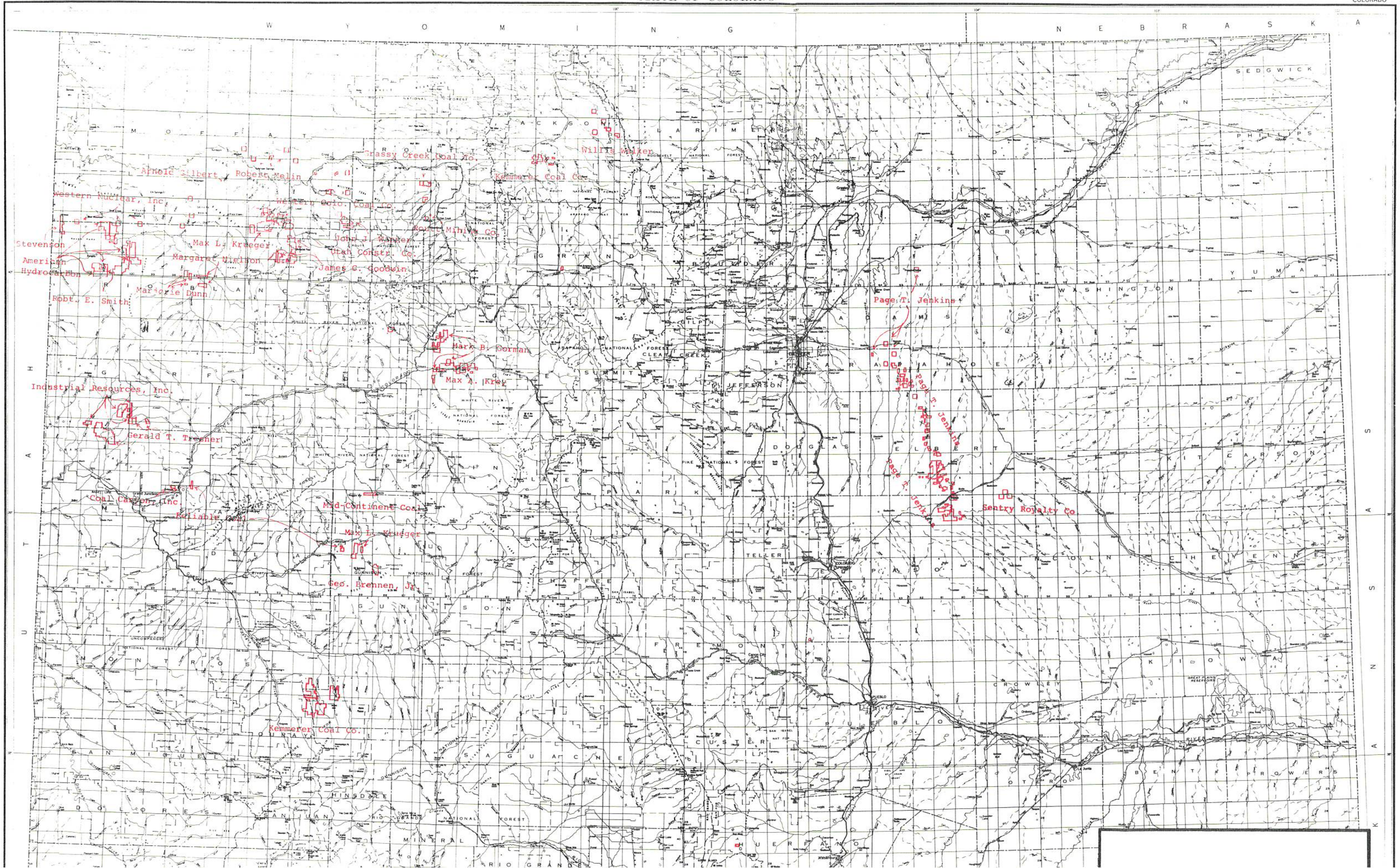
	Lease, Acres	Permit, Acres	County
American Hydrocarbon Salt Lake City		19,404(e)	Rio Blanco
Coal Canyon, Inc. Grand Junction	2,271		Mesa
Arnold Gilbert Denver	640	4,528(a)	Moffat
Industrial Resources, Inc. Denver		14,878(b)	Garfield
Max Krueger Laramie		12,330(a)	Moffat and Gunnison
Mid-Continent Coal Co. Chicago	1,760		Pitkin
Pittsburg & Midway Coal Kansas City		2,560	Routt
Robert Smith Salt Lake City		6,551	Rio Blanco
Wm. Stevenson Salt Lake City		2,018	Moffat
Utah Constr. and Mining San Francisco	2,250	2,400(e)	Moffat

(a) Application
(b) By Assignment
(e) Permit Extended

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

STATE OF COLORADO

COLORADO



COLORADO COAL STATISTICS (Continued)

Coal Land Activities in Colorado in 1966 (Map)

A map of the significant activities on Federal and State of Colorado coal properties is presented on the next page. The indicated areas are either leases or exploration permits, issued or applied for, in 1966. The map summarizes the transactions in coal presented in these reports during the past year and is intended to point out those areas of greatest interest.

OTHER COLORADO NEWS NOTED

Colorado May Be The Site of a Large W.E.S.T. Plant

Cameron and Jones has learned that several sites in Colorado have been studied as potential locations for future coal-fired power plants by associates of W.E.S.T. (Western Energy Supply and Transmission Associates). However, there is no indication that any plants will be built in Colorado in the immediate future.

Senate Bill Would Nullify Some Mineral Leases

A bill has been proposed to the current session of the Colorado legislature, Senate Bill No. 1, which is intended to clear the records of the courthouses across the state of "dead" leases. It states that an affidavit must be filed before the six-month primary lease for minerals has expired in which the lease-holder expresses his intent to renew the lease. Failure to do so will cause the original filing to be discarded and the result would be the same as if the original agreement had never been filed. The bill says it applies to all land in Colorado, but the Bureau of Land Management informs us that it can not adversely affect Federal leases.

Hayden Plant Continues to Operate, Illegally?

About one year ago, on February 14, 1966, the Colorado Supreme Court found that the certificate of convenience and necessity issue by a split decision of the State Public Utilities Commission for the Hayden Power Plant was not valid. Without a valid certificate the plant cannot legally operate. In fact, the Colorado Supreme Court has ordered that the plant be shut down and dismantled. The Federal Supreme Court denied Colorado Ute Electric Association, owner of the plant, an appeal from the State decision and it also denied a motion for rehearing and reconsideration.

At the moment the plant continues to operate, seemingly illegally. The government is involved to about $30 million in Rural Electrification Administration funds which constitute a mortgage. The Salt River Project in Arizona is a major customer for the power produced. Peabody Coal Company supplies the fuel. The plant is rated at 150 megawatts and it went into commercial production in July, 1965.

Several avenues of escape from this legal entanglement have been investigated. Nobody believes that the facilities will be demolished or even shut down. Colorado Ute along with some of its customers has appealed to the Federal Power Commission to please take jurisdiction over them since they are, really, a public utility. They are, in reality, an electric cooperative, and the FPC can hardly accept jurisdiction (even if they have the legal right) without also taking over all co-ops and this would be very unpopular. FPC has not acted. The government could foreclose to protect its interest and take the plant out of the jurisdiction of Colorado. In this case, thegenerated power could be fed into a Bureau of Reclamation circuit. This would not be popular and is highly unlikely. However, it appears that merely fighting in the courts will keep the plant operative for five or ten years.

A possible solution may result from a bill introduced in the Colorado Senate which would permit co-ops who have distribution systems to generate power to supply those systems. This would legalize the Hayden Plant and end the confusion. However, Senator Hahn, one of the bill's sponsors, has told us that the bill faces very rough sledding and he is not optimistic about its passage this session of the legislature.

Colorado Strives to Obtain OCR Project

Colorado ranks eleventh among the states in coal production and produces about one percent of the nation's coal. Colorado has seen contracts awarded by the Office of Coal Research go to organizations who are doing their research and development in states without significant coal production. Especially since several of the projects are reaching the pilot plant stage and sizable payrolls are involved, the pilot plant brings economic advantages to the area where it is located. Recently, a large pilot plant for gasifying coal was announced for Rapid City, South Dakota, and one for de-ashing coal was announced for Tacoma, Washington. Neither South Dakota nor Washington produces much coal.

Colorado legislators apparently want an OCR project located in the state and decided to do something about it. On January 27, 1967, the Mineral Resources Committee of the Colorado House of Representatives had George Fumich, Jr., Director of the Office of Coal Research, address them. He explained the operation of his office. In response to questions on how Colorado might get a pilot plant, he suggested that Colorado propose such to his office. He pointed to the fact that Colorado was not supporting any coal research and he thought that it should--that a research program might suggest subjects to propose to OCR. He thought such a proposal should be on a project which might benefit a sizable portion of the country rather than just Colorado.

Mr. William Bear, Western Slope mine operator, suggests that $100,000 in matching funds be appropriated to attract a project. Mr. Bear serves on the Technical Advisory Committee for OCR. Several Representatives expressed a desire for a small appropriation to support

OTHER COLORADO NEWS (Continued)

a coal research effort at the Colorado School of Mines. Dr. Kuhn, dean of faculty at the School of Mines suggests that the experimental work might be done at the government's Anvil Points facility which the school now leases for oil shale research.

UTAH ACTIVITIES CONTINUE

Coal Land Leases and Application for Permits Areas are Large

Carbon County received much attention as R. J. Hollberg, Jr. of Salt Lake leased 21,700 acres of state coal lands, G. W. Anderson of Salt Lake applied for an exploration permit on 40,247 acres, U. S. Fuel Co. of Salt Lake applied for a permit on 4,374 acres, and G. E. Jacober of Denver applied for 2,627 acres. Garfield County was the scene of both leases and applications for permits by a newcomer, Delcoal, Inc., of Kansas City. The tabulation of new holders of leases and exploration permits on public lands follows on page 3-21.

Kaiparowits Plant Awaits Mining Bids

There have been no announcements on the proposed Kaiparowits power complex since August 18, 1966. At that time, Resources Company, acting for the three owners, asked coal companies to bid on mining Resource's coal. Deadline for filing of bids is February 28, 1967. The next issue of this report will discuss the bids and announce the successful bidder if one is selected. This project is scheduled to go into production about 1973.

UTAH ACTIVITIES CONTINUE (Continued)

Coal Leases and Exploration Permits on Public Lands During the Past Three Months in Utah

	Lease, Acres	Permit, Acres	County
G. W. Anderson Salt Lake City		40,247(a)	Carbon
Wm. G. Bush Grand Junction		3,560(a)	Emery
Delcoal, Inc. Kansas City	1,720	29,480(a)	Garfield
Lois Grossman Costa Mesa, Calif.		7,680	Kane
R. J. Hollberg, Jr. Salt Lake City	21,700		Carbon
R. L. Healy Salt Lake City	320		Garfield
John Howell Denver	6,295		Sevier
G. E. Jacober Denver		2,627(a)	Carbon
Ted J. Peterson Salt Lake City	640	8,620	Grand
W. L. Rasmussen Veyo, Utah	640	13,885(a)	Kane
U. S. Fuel Company Salt Lake City		4,374(a)	Carbon
Utah Const. & Mining San Francisco		560	Kane

(a) Application filed

WYOMING

Coal Leases and Exploration Permits on Public Lands During the Past Three Months in Wyoming

	Lease, Acres	Permit, Acres	County
Fred Blume Cheyenne	1,280		Sweetwater
C. H. Evitt Casper		10,560(a)	Sweetwater
Paul Faust Denver	11,164		Campbell
Page Jenkins Casper		19,930(a)	Campbell & Johnson
Kerr-McGee Corp. Oklahoma City		3,892(e)	Campbell
J. R. Learned Cheyenne	1,879		Converse
Burton Lowe Cheyenne		3,230	Uinta
Northern Wyo. Land Co. Buffalo, Wyo.	640		Johnson
Sentry Royalty Co. St. Louis	11,141		Campbell
G. E. Sorenson Frontier, Wyo.		2,253(e)	Sweetwater & Carbon
Eugene Stevens Casper		3,032	Converse

(a) Application filed
(e) Permit extended

WYOMING (Continued)

	Lease, Acres	Permit, Acres	County
Texaco, Inc.		1,121 (4,001 rejected)	Campbell
Pacific Power and Light Portland	2,908		Converse
		3,520(a)	Sweetwater
U. S. Steel Corp. Pittsburgh, Pa.		9,920	Sweetwater
John Wanner Denver		19,930(a)	Campbell & Johnson
John Wold Casper	640		Campbell
		17,759(a)	Converse

(a) Application filed

ARIZONA MAY BE SITE OF A COAL-FIRED POWER PLANT

A Major Power Plant Considered for Page

When Secretary Udall recently announced his plan for the Central Arizona Project he mentioned the possibility of purchasing 400 megawatts required for pumping purposes from a private coal-fired thermal power plant. Some of the associates of W.E.S.T. have discussed the possibility of constructing a large power plant at Page, which is near Lake Powell. Although the plant is still in the speculation stage, water might be available from Arizona's share of the upper Colorado River. If this should turn out to be the source of water, Arizona would probably insist that Arizona coal be burned under the boilers. There is a large supply of Kaiparawits coal in Utah nearby, but it is conceivable that coal from the Black Mesa of Arizona could be used. Peabody Coal Company says they have sufficient reserves. There are no railroads in the area but delivery could be made by coal-slurry pipeline.

WASHINGTON POWER PLANT DUE ON-STREAM IN 1973

Coal-Fired Thermal Plant Announced

Pacific Power & Light Company disclosed plans to build a $118 million coal-fired power plant near Centralia, Washington. Construction will start in 1969 and the first 500 megawatt unit is planned. Two additional 500 megawatt units may be added later. This announcement is sensational because the coal-fired plant was found to be cheaper than nuclear and this is the first thermal plant in an area long dependent on hydropower.

APPENDIX

Reproduction of MEMORANDUM OPINION AND ORDER on Civil Actions Involving Oil Shale Properties, U. S. District Court, December 21, 1966:

FILED
United States District Court
Denver, Colorado
DEC 21 1966
G. WALTER BOWMAN
CLERK
BY ____________ DEP. CLERK

IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF COLORADO

THE OIL SHALE CORPORATION AND ENERGY RESOURCES TECHNOLOGY LAND, INCORPORATED,
Plaintiff,
v.
STEWART L. UDALL, Secretary of the Interior,
Defendant.
Civil Action No. 8680

JOSEPH B. UMPLEBY and WASATCH DEVELOPMENT CO.,
Plaintiffs,
v.
STEWART L. UDALL, Secretary of the Interior,
Defendant.
Civil Action No. 8685

BARNETTE T. NAPIER, GRACE A. SAVAGE, JOAN L. SAVAGE, MAUDE B. FARNUM, ST. CLAIR NAPIER CATLIN, WILLIAM H. FARNUM, JR., JOHN R. FARNUM, JOHN W. SAVAGE, and NEIL S. MINGER,
Plaintiffs,
v.
STEWART L. UDALL, Secretary of the Interior,
Defendant.
Civil Action No. 8691

PENELOPE CHASE BROWN, individually and as trustee, and THE OIL SHALE CORPORATION,
Plaintiffs,
v.
STEWART L. UDALL, Secretary of the Interior,
Defendant.
Civil Action No. 9202

Messrs. Tweedy, Mosley, Aley & Young, Attorneys at Law, 1700 Broadway, Denver, Colorado, for Plaintiffs in Civil Actions Nos. 8680 and 9202. Messrs. Cleary, Gottlieb, Steen & Hamilton, 52 Wall Street, New York, New York, Of Counsel in Civil Actions Nos. 8680 and 9202; Mr. Fred M. Winner, Attorney at Law, 500 Capitol Life Center, Denver, Colorado, Of Counsel in Civil Action No. 8680.

Mr. Edward N. Juhan, Attorney at Law, 7675 West Fourteenth Avenue, Denver, Colorado, Mr. Fred M. Winner, Attorney at Law, 500 Capitol Life Center, Denver, Colorado, and Mr. William S. Livingston, Attorney at Law, Lincoln Tower Building, Denver, Colorado, for Plaintiffs in Civil Action No. 8685.

Messrs. Schmidt and Van Cise, Attorneys at Law, Richard L. Eason, Esquire, 1310 Denver Club Building, Denver, Colorado, for Plaintiffs in Civil Action No. 8691.

Mr. Lawrence M. Henry, United States Attorney for the District of Colorado, United States Court House, Denver, Colorado; Mr. David I. Shedroff, Assistant United States Attorney, Denver, Colorado; Mr. Thomas L. McKevitt, Attorney, Department of Justice, Washington, D.C. for Stewart L. Udall, Secretary of the Interior; Mr. Robert W. Mesch, Attorney, Office of Regional Solicitor, Department of the Interior, Denver, Colorado, and Mr. Lowell Madsen, Attorney, Office of Regional Solicitor, Department of the Interior, Denver, Colorado, Of Counsel for Defendant in all actions.

MEMORANDUM OPINION AND ORDER

DOYLE, Judge.

The four above-named actions arise under the Constitution and laws of the United States. Plaintiffs in all four actions seek an adjudication that certain decisions of the Department of the Interior, hereinafter the Department, regarding oil shale placer mining claims in Colorado are erroneous, invalid and without force and effect. Plaintiffs in Civil Action Nos. 8685, 8691 and 9202 seek mandatory orders to compel the Department to issue patents on several placer claims pursuant to certain applications filed by plaintiffs. Plaintiffs in Civil Action No. 8680 have not filed a patent application, but seek a declaratory judgment regarding their alleged rights to gain patents from the Department on several of the Colorado oil shale mining claims. The trial was to the Court. Extensive trial and post-trial briefs have been filed, voluminous exhibits have been received in evidence, and oral arguments have been presented. The case now stands submitted.

There are few factual disputes. Most of the controversy concerns the policies of the Department and certain Supreme Court decisions relating to extensive oil shale reserves in Colorado, Utah and Wyoming. For the sake of clarity, the position of the plaintiffs in each of the consolidated cases will be summarized at the outset. The specific facts surrounding the claims in the several actions are related so as to clarify the issues and furnish basis for the decisions.

Civil Action No. 8680

Plaintiffs, The Oil Shale Corporation and Energy Resources Technology Corporation, Inc. are, respectively, Nevada and Colorado corporations. Energy Resources allegedly owns certain oil shale mining claims, referred to as the Group A Bute Claims (officially entitled Bute Placer Mining Claims Nos. 1-19, inclusive, 21-28 inclusive, and 30-32 inclusive). The Oil Shale Corporation allegedly owns the Group B Bute Claims (officially entitled Bute Placer Mining Claims Nos. 33-48, inclusive), the Camp Bird Claims (officially entitled Camp Bird Placer Mining Claims Nos. 1-20, inclusive) and the Atlas Claims (officially, the Atlas Placer Mining Claims Nos. 1, 2, 3, 7, 9, 10, 12, 17, 18). All of these claims are located in Rio Blanco County, Colorado; all allegedly contain valuable oil deposits.

Plaintiffs trace their interests in these claims through one Tell Ertl who, during the 1950's, acquired them from the original claimants and their successors in interest by purchase and forfeiture proceedings under Title 30 U.S.C. § 28. Hamilton v. Ertl, 146 Colo. 80, 360 P. 2d 660 (1961). All of the claims were allegedly located by the original claimants during December, 1919 and January, 1920. Thus they predate enactment of the Mineral Leasing Act of February 25, 1920, 41 Stat. 437, Title 30 U.S.C. § 181, et seq. This act changed the mining law policy in that certain mineral lands were withdrawn from location.

In 1927, the Department instituted certain contest proceedings, Contest Nos. 11,757, 11,759 and 11,761 against the original claimants regarding the above mining claims. On May 4, 1928, the Commissioner, General Land Office, issued letter decisions declaring the claims null and void for the failure of the named contestees to appear upon notice and process purportedly served and answer charges alleging their failure to perform annual assessment work for the years ending July 1, 1921 to 1927, inclusive, as required by 30 U.S.C. § 28.

Plaintiffs contend that the Supreme Court has, on two occasions, held that the Department lacked authority to declare mining claims null and void for failure to perform annual assessment work. Wilbur v. United States ex rel. Krushnic, 280 U.S. 306, 50 S. Ct. 103 (1930); Ickes v. Virginia-Colorado Development Corporation, 295 U.S. 639, 55 S. Ct. 888 (1935). Their further contention is that in any event the contestees were not given proper notice of the contest proceedings. They allege that following the Supreme Court's decisions in Wilbur v. Krushnic, supra, and Ickes v. Virginia-Colorado Development Corporation, supra, the defendant's predecessors in office and various officials and employees of the Department repeatedly and publicly affirmed that the decisions in the assessment work contest proceedings, including Contests Nos. 11,757, 11,759 and 11,761, were null and void; that from 1935 until 1962, the defendant and his predecessors in office issued land patents covering at least 74,000 acres of oil shale claims which had been declared null and void in assessment work proceedings such as those here involved, and which were in all respects of fact and law the same as the mining claims referred to above in which plaintiffs allege to have an interest. Plaintiffs argue that by reason of these acts the Department has adopted a rule of law, which cannot be retroactively altered, that the assessment work contests had no effect on the validity of mining claims. It is further alleged that the plaintiffs and their predecessors in interest have relied upon the rule of law purportedly adopted by the Department.

In 1962, plaintiff Energy Resources and others applied for patents on certain mining claims which had been the subject of departmental contest proceedings during 1930 - 1933 involving issues identical to those raised in Contest Nos. 11,757, 11,759 and 11,761. On February 16, 1962, the Manager of the Colorado Land Office, Bureau of Land Management, issued an opinion rejecting the applications on the ground that while the original cancellations may have been erroneous as a matter of law at the time they were made, the principles of finality of administrative action, estoppel by adjudication, and res judicata prevent their now being challenged and consequently bar the patenting of such claims. The Manager's decision was affirmed by the Solicitor of the Department on April 17, 1964. Union Oil Company of California, et al., 71 I.D. 169 (1964). The plaintiffs assert that they have exhausted their administrative remedies and that the case is now ready for judicial review. They seek a mandatory injunction compelling the Department to expunge from Department records any decisions, orders, judgments or cancellations entered with respect to the mining claims of plaintiffs in Contests Nos. 11,757, 11,759 and 11,761. They also seek a declaratory judgment declaring such contest proceedings to be of no effect, and an injunction barring the Department from relying upon them to bar their patent applications, and any further relief appropriate.

Civil Action No. 8685

Plaintiffs Umpleby, a Texas citizen, and Wasatch Development Company, a Colorado corporation, seek similar relief in regard to certain mining claims in Garfield County, Colorado, known as the Carbon and Elizabeth claims. Plaintiff Umpleby is a successor in interest from the original claimants and the alleged owner of an undivided thirteen and one-half per cent interest in the unpatented Carbon Nos. 1 through 6 and Elizabeth Nos. 1 through 12 oil shale placer mining claims. Plaintiff Wasatch Development Company is a successor in interest from the original claimants and the alleged owner of an undivided eighty-six and one-half per cent interest in these claims. The claims were allegedly located in 1918, prior to the enactment of the Mineral Leasing Act.

These claims were also the subject of a contest proceeding, Contest No. 12029, initiated by the Department against Umpleby and others in 1929, in which they were declared invalid for failure to perform annual assessment work. On September 8, 1959, plaintiffs filed application for mineral patent (Colo. 030979) on the Carbon Nos. 1 through 4 and Elizabeth Nos. 1, 2, 4 through 12 claims.

In Union Oil Company of California, et al., supra, the Land Office Manager's rejection of this patent application was affirmed by the Solicitor. Plaintiffs make assertions similar to those made by plaintiffs in Civil Action No. 8680. They seek a declaration that the Union Oil Company decision is void because of the Supreme Court's decisions in Wilbur v. Krushnic, supra, and Ickes v. Virginia-Colorado Development Corporation, supra, and the Department's subsequent affirmance thereof, and pray for a mandatory injunction compelling the Department to take such action as is necessary to issue patents to them.

Civil Action No. 8691

In this action, plaintiffs Napier and Grace Savage are California citizens, and plaintiffs Joan Savage, M. B. Farnum, Catlin, W. H. Farnum, J. R. Farnum, John Savage and Mincer are Colorado citizens. Plaintiffs are successors in interest and the alleged owners of three oil shale placer mining claims in Garfield County, Colorado, known as the Northwest, Northeast and Southeast claims. These claims were allegedly located by plaintiffs' predecessors in 1918, prior to the enactment of the Mineral Leasing Act. They also were the subject of a contest proceeding, Contest No. 12972, initiated by the Department in 1931, wherein the claims were declared invalid for failure to perform annual assessment work. On June 1, 1959, the plaintiffs applied for a patent on the claims involved here. This application was also rejected by the Manager of the Colorado Land Office and affirmed by the Solicitor, Union Oil Company of California, et al., supra. Plaintiffs also contend that this decision is contrary to law and the settled practice of the Department. They seek a mandatory injunction compelling the Department to take such action as is necessary to issue the patents applied for, and a judgment declaring the departmental decisions adversely affecting their claims to be null and void, and other appropriate relief.

Civil Action No. 9202

Plaintiff Brown is a Colorado citizen, and is the successor in interest and the alleged owner of certain oil shale placer mining claims in Garfield County, Colorado, known as the Oyler claims (officially the Oyler Oil Shale Placer Mining Claims Nos. 1-4). Plaintiff The Oil Shale Corporation is a Nevada corporation holding a lease and option to purchase the Oyler claims. The Oyler claims were allegedly located in 1916, prior to the enactment of the Mineral Leasing Act. They too were the subject of departmental investigations and contest proceedings prior to the Supreme Court's decision in Ickes v. Virginia-Colorado Development Corporation, supra. The Department concluded from an investigation in 1918 that the claims had been properly located. A second investigation in 1920 affirmed the continued validity of the claims. In 1929, a contest proceeding, Contest No. 12039, similar to those discussed above, resulted in a declaration invalidating the claims for failure to perform annual assessment work. In 1948, the sole surviving directors of the then

record title holder of the claims, the Index Shale Oil Company, a dissolved corporation, conveyed the claims to plaintiff Brown and her husband. In 1955, the Browns conveyed the claims to the Pacific Oil Company, which filed a patent application in September of the same year, Colorado No. 012327. This application was also rejected by the Manager of the Colorado Land Office on February 16, 1962, and affirmed by the Solicitor in Union Oil Company of California, et al., supra. Apparently as a result of the Land Office Manager's decision in 1962, the Pacific Oil Company reconveyed the claims to plaintiff Brown. The lease-option agreement with plaintiff The Oil Shale Corporation was executed thereafter. Plaintiffs here make the same assertions and seek similar relief to that asked by plaintiffs in Civil Action No. 8680.

In summary, the plaintiffs assert at least three separate and independent reasons for according the relief sought in these consolidated actions:

1. The 1928-1933 contest proceedings of the Department are void for lack of jurisdiction and can give no basis for the Union Oil decision on any theory.

2. In 1935, the Department adopted a rule that the 1928-1933 contest decisions would be regarded as void and without force and effect and this rule cannot be reversed retroactively.

3. Even if the 1928-1933 decisions are regarded as merely erroneous, but supported by subject matter jurisdiction, the plaintiffs in the circumstances above described can now seek direct review and obtain their reversal.

The Assessment Work Issue: Departmental View Prior to the Krushnic and Virginia-Colorado Decisions

The Department's broad power over the public lands gives it an undisputed jurisdiction over most aspects relating to the validity of mining claims, e.g., marking of claims, discovery, mineral character of the land, particularly when a patent application has been filed. Cameron v. United States, 252 U.S. 450, 40 S.Ct. 410 (1920); Best v. Humboldt Placer Mining Company, 371 U.S. 334, 83 S.Ct. 379 (1963). In view of the scope of its acknowledged powers, the Department has, in recent decades, been reluctant to accept the proposition that it lacks power to question the sufficiency of assessment work performance in order to take possession of claims for the Government where such work is in default.[1] Under the mining laws, the penalty for failure to do assessment work traditionally has been that other private parties are empowered to enter onto the lands and relocate the claim. E.g., Belk v. Meagher, 104 U.S. 279, 26 L.Ed. 736

---

[1] That a distinction has been made between the Department's power to invalidate claims for non-performance of assessment work and its power to do so for other defects is illustrated by the following extract from The Federal Shale Oil Company, 53 I.D. 213, 216 (1930):

> "Putting aside for the moment the question, whether departmental authority exists to attack mining claims for failure to do annual work, it can not be disputed that such authority exists to determine whether a valid claim was initiated prior to the date of the act by doing the acts the mining law prescribed, such as marking the boundaries so that they might be readily traced, making a discovery of mineral prior to the act, or thereafter as a result of work diligently in prosecution at its date.

(1881); Swanson v. Sears, 229 U.S. 180, 32 S. Ct. 455 (1912); Knight v. Flat Top Mining Co., 6 Utah 2d51, 305 P.2d 503 (1957). Where there are co-owners to a mining claim, one co-owner can, by performing assessment work where the others do not, obtain complete ownership of the claim through forfeiture proceedings under 30 U.S.C.A. § 28. Hamilton v. Ertl, supra. In recent years, the Department has asserted its thesis that relocation for assessment work default is also a remedy available to the Government, and within its jurisdiction But this has not always been its position.

In an early decision, P. Wolenberg, et al., 29 L.D. 302 (1899), the Secretary of the Interior recognized that the Department had no jurisdiction under the pre-Mineral Leasing Act mining laws to inquire into a charge of failure to perform assessment work. The Secretary reviewed the action of the Land Office Commissioner in ordering a hearing to determine whether annual assessment work had been performed on a contested claim. In vacating the order for a hearing on this question the Secretary made the following comments:

> "Ordinarily an order of your office directing a hearing, being an interlocutory proceeding, will not be disturbed upon appeal. Indeed, generally speaking, such an order is not appealable. This rule, however, is not without exception, and where it is made to appear that the order involves matters which the land department can not inquire into. . . the same may be considered and corrected or wholly vacated when brought to the attention of the Department, whether by direct appeal or otherwise.
>
> "In the present case the order for a hearing, in so far as it directs an inquiry into the charge of failure to make an expenditure of one hundred dollars, in labor or improvements, on the Mascot claim during the year 1896, and the alleged relocation of the claim by reason thereof, clearly relates to matters over which the land department is without authority. The annual expenditure of one hundred dollars, in labor or improvements, required by section 2324 of the Revised Statutes, is solely a matter between rival and adverse claimants to the same mineral land, and goes only to the right of possession, the determination of which is committed to the courts, and not to the land department. In this respect the requirement made by section 2324 is essentially different from that made by section 2325, which makes the expenditure of five hundred dollars, in labor or improvements, a condition to the issuance of patent, and therefore a matter between the applicant for patent and the Government, the determination of which is committed to the land department. * * *
>
> "The action of your office in ordering a hearing to determine whether the annual assessment work for 1896 had been done upon the Mascot, and, if not, whether work upon that claim had been resumed before the alleged relocation thereof, was erroneous." 29 L.D. at 303-04.

See also Barklage et al. v. Russell, 29 L.D. 401 (1900); Nielson v. Champagne Mining & Milling Co., 29 L.D. 491 (1900); Cain et al. v. Addenda Mining Co. (On Review), 29 L.D. 62 (1899).

Following these early decisions the Department took a different view in cases involving the right of mining claimants to lands subsequently withdrawn or reserved from mining locations. Thus, in Navajo Indian Reservation, 30 L.D. 515 (1901), the Department held that a valid mining location subsisting at the time of the reservation of lands as an Indian Reservation was excepted from the effect of the withdrawal and that such claim was subject to relocation upon failure of the original claimant to perform annual assessment work. The Secretary refused to determine whether the original locators had defaulted, and whether the alleged relocators had succeeded to their rights, holding this to be a matter for the courts. However, he did consider the effect of the withdrawal upon the subsequent default of prior claims. Depending upon how the reservation was worded, the Secretary concluded, it might attach upon default of an existing claim so as to prevent relocation or it might never attach, regardless of the subsequent default. If, for example, the reservation did not flatly exclude the prior claims, but merely exempted them for so long as they are properly "maintained," a default in such "maintenance" would bring the land under the withdrawal and hence under the control of the Government.

The effect of a withdrawal under the reclamation act for irrigation works, 32 Stat. 388, was considered in a Departmental Instruction dated January 13, 1904, 32 L.D. 387. The Secretary noted that an unperfected mining claim is merely a possessory right which is liable to be divested for failure to maintain the claim in accordance with the mining laws and local regulations applicable thereto. He then stated that the land department has jurisdiction to determine whether the claimant has defaulted and to declare by its judgment whether such right has been divested so as to restore the land to the control of the Government. A decade later, in E. C. Kinney, 44 L.D. 580 (1916), this principle was followed to support the asserted jurisdiction of the Department to determine whether placer mining claims on withdrawn lands were subsequently defaulted for failure to perform annual assessment work. In referring to the January 13, 1904, Instruction, the Assistant Secretary said:

> "This is undoubtedly the true rule, for where a claimant is in default so that his claim could be defeated by another individual adverse claimant, surely the Government, desiring to devote the land to an important public use, may likewise take advantage of the default and divest the claim so as to free the land for Government use." 44 L.D. at 582.

As has been mentioned, the Mineral Leasing Act of 1920 instituted a new policy with respect to certain minerals, including oil shale, by withdrawing them from location and patent. After its enactment, many prior locators ceased doing annual assessment work on claims for minerals included under the Act on the ground that if such claims could no longer be located, neither could they be *re*located. An investigation by the Department after the enactment of the Leasing Act showed that work had stopped on many claims. Many contests were initiated alleging that failure to perform the work resulted in forfeiture of the claims to the United States. In bringing these contest proceedings the Department took the position that its jurisdiction to inquire into the validity of mining claims was enhanced by the new policy propounded by the Act. The Department reasoned that the provision of Section 37 of the Act, excepting from its coverage valid existing claims thereafter "maintained in compliance with the laws under which initiated," impliedly gave the Secretary the authority to determine what lands are subject to lease and what lands are within the exception of valid claims. In the Department's

view, maintenance "in compliance with the laws under which initiated" included the performance of annual assessment work; hence, the Secretary's implied authority to determine what claims fell within the exception necessarily gave him jurisdiction to invalidate claims for non-performance of such work.

The Supreme Court Decisions

The leading Department case enunciating this viewpoint was *Emil L. Krushnic*, 52 L.D. 295 (1929). There, the petitioner's application in 1922 for patent to certain oil shale placer claims was denied for failure to perform assessment work during 1920, although he had resumed such work in 1921 and 1922. The Commissioner ruled that to maintain a claim "in compliance with the laws under which initiated means, among other things, the performance of $100 worth of annual labor and improvement prescribed by section 2324, Revised Statutes . . . ," and that failure to fulfill this requirement *automatically* terminated the claim and rendered it subject to disposition only under the leasing act. In affirming the Commissioner the Secretary emphasized the automatic nature of the termination upon default in performing the yearly labor.

> "Section 37 [of the Leasing Act] at one blow destroyed the right of relocation of such minerals and with it fell the right of resumption. * * * The fair and obvious meaning of section 37 is that if the annual work is not done, all the rights of the claimant *are* gone."
>
> * * * * *
>
> "The contention that the Federal Government must act the part of an adverse claimant in this

> and similar cases and be alert and vigilant and take some affirmative action to terminate the rights of a defaulting claimant before he resumes work, such as by physical reentry, or institution of adverse proceedings in the department or by bringing an ouster suit in the courts, is untenable." 52 L.D. at 297, 301-03.

Since he viewed the forfeiture to be automatic, immediately vesting the Government with complete control and ownership of the land, the Secretary was able to distinguish between the Department's jurisdiction under the general mining laws to settle disputes over assessment work performance between private adverse claimants and its jurisdiction under the Leasing Act to invalidate claims on its own initiative for failure to perform the annual labor.

> "The situation here is entirely different. The leasing act, as stated, repealed as to shale deposits the general provisions of the mining law and withdrew them from location and disposition thereunder and was a legislative assertion of control and ownership thereof by the United States, except as specifically provided in section 37 of the act. It is the duty of the department to scrutinize claims that are asserted to be within the exceptions and ascertain whether the government or the individual has the better right. The question is one of validity, and under section 37 maintenance is an essential element of validity. Only controversies between adverse claimants under conflicting mining locations of the same land, and which relate solely to the right of possession are committed exclusively to the courts. . . ." 52 L.D. at 303.

Following this ruling in *Krushnic* the land office instituted numerous assessment work contests. Annual Report of the Secretary of the Interior, Fiscal Year 1928, page 11. Included in these proceedings were Contest Nos. 11757, 11759, 11761, 12029 and 12039, regarding the placer claims in Civil Actions Nos. 8680, 8685 and 9202. Meanwhile, however, *Krushnic* found its way to the Supreme Court. The decision of the Department was there reversed. The Supreme Court ruled that the Secretary's decision that cessation of assessment work automatically terminates the claim "violates the plain words of the excepting clause of the Leasing Act." Wilbur v. United States ex rel. Krushnic, supra, 280 U.S. at 318, 50 S.Ct. at 105. The reasoning was that while performance of annual labor "maintains" a claim,

> "the owner equally maintains his claim, within the meaning of the Leasing Act, by a resumption of work, unless at least some form of challenge on behalf of the United States to the valid existence of the claim has intervened. . ." 280 U.S. at 317-18, 50 S.Ct. at 105.

Failure to perform assessment work on a claim located prior to the leasing act, the court concluded, only renders it subject to loss by relocation and is without effect so far as the Government is concerned.

> "The owner [of a mining claim] is not required to purchase the claim or secure patent from the United States; but, so long as he complies with the provisions of the mining laws, his possessory right, for all practical purposes of ownership, is as good as though secured by patent. While he is required to perform labor of the value of $100 annually, a failure to do so does not *ipso facto* forfeit the claim, but only renders it subject to loss by relocation. And the law is clear that no relocation can be made if work be resumed after default and before such relocation.
>
> "Prior to the passage of the Leasing Act, annual performance of labor was not necessary to preserve the possessory right, with all the incidents of ownership above stated, as against the United States, but only as against subsequent relocators. So far as the Government was concerned, failure to do assessment work for any year was without effect. Whenever $500 worth of labor in the aggregate had been performed, other requirements aside, the owner became entitled to a patent, even though in some years annual assessment labor had been omitted. P. Wolenberg, et al., 29 L.D. 302, 304; Nielson v. Champagne Mining & M. Co., 29 L.D. 491, 493. 280 U.S. at 317, 50 S.Ct. at 104-05.

The decision in Krushnic did not put at rest the problem of jurisdiction, at least not for the Department. The Department's interpretation was that it prohibited the Government's invalidating mining claims for failure to perform assessment work only where the claimant has resumed the assessment work before "some form of challenge on behalf of the United States to the valid existence of the claim has intervened."[2] The Department then undertook to investigate the validity of oil shale claims upon which assessment work had stopped and had not been resumed. It posted a notice on each such claim. This declared that the United States had taken possession of the land for its exclusive use and benefit. Numerous such notices were posted; many contest proceedings were instituted; and many claims covering hundreds of thousands of acres were declared null and void. Annual Report of the Secretary of the Interior, Fiscal Years 1930, p. 14; 1931, p. 65; 1932, pp. 18, 58; 1933, p. 60.

> "It is the department's view that a challenge of an oil shale claim which is in default for the nonperformance of assessment work, by notice of the preferment of a charge against the claim to that effect in a proceeding instituted in accordance with the regulations of February 26, 1916, Circular No. 460 (44 L.D. 572), while such default continues to exist, and a judgment by the department that the charge is sustained after due notice and opportunity to be heard, has the same effect in the extinguishment of the claim as would a valid relocation of a mining claim located on account of minerals other then those mentioned in the leasing act." The Federal Shale Oil Company, supra, 53 I.D. at 221.

---

[2] The Federal Shale Oil Co., 53 I.D. 213, 220 (1930). See also, Francis D. Weaver, 53 I.D. 175 (1930), On Rehearing, 53 I.D. 179 (1930); Virginia-Colorado Development Corporation, 53 I.D. 666 (1932); State v. Madell, 53 I.D. 195 (1930); Instructions,

On April 1, 1933, the Department suspended these actions to await "court decisions on [the] jurisdiction of the Department to challenge the validity of oil shale locations for failure to perform annual labor thereon." Annual Report of the Secretary of the Interior, Fiscal Year 1934, p. 65. The litigation referred to was culminated in the Supreme Court's decision in Ickes v. Virginia-Colorado Development Corporation, supra.

In Virginia-Colorado, the Court reviewed a decree requiring the Secretary of the Interior to vacate certain adverse proceedings together with his decision declaring certain placer claims of the plaintiff in that case to be void. Plaintiff had alleged that he had located oil shale placer claims on mineral lands of the United States in Colorado in June, 1917. Annual assessment work had been performed for each year through July 1, 1930, but none had been done during 1931 when the Department initiated adverse proceedings challenging the claim for nonperformance of the work and failure to resume prior to the contest proceedings.

The Supreme Court affirmed this decree and in so doing the opinion by Mr. Justice Hughes, declared and clarified several points.

First, the decision reaffirmed the holding in Krushnic as to the character of the right acquired. On this it quoted:

---

2 (Continued)
Government Proceedings Against Oil Shale Claims for Default in Assessment Work, 53 I.D. 131 (1930).

> ". . . Restating the rule declared by many decisions, we said in Wilbur v. U.S. ex rel. Krushnic, 280 U.S. 306, 316, 50 S.Ct. 103, 104, 74 L.Ed. 445, that such a location, perfected under the law, 'has the effect of a grant by the United States of the right of present and exclusive possession. The claim is property in the fullest sense of that term.' It is alienable, inheritable, and taxable."

Secondly, it again spelled out the extent of the Department's authority as follows:

> "There was authority in the Secretary of the Interior, by appropriate proceedings, to determine that a claim was invalid for lack of discovery, fraud, or other defect, or that it was subject to cancellation by reason of abandonment. [Citing cases]
>
> "The Leasing Act of 1920 inaugurated a new policy. Instead of the acquisition of rights by location, the act provided for leases. But by express provision, the act saved existing valid claims 'thereafter maintained in compliance with the laws under which initiated, which claims may be perfected under such laws.' Section 37 of the act (30 USCA § 193). What then was the status of plaintiff's claims under this exception? They were originally valid claims. No question is raised to the contrary. There is no suggestion of lack of discovery, fraud, or other defect. There is no ground for a charge of abandonment. The allegations of the bill, admitted by the motion to dismiss, dispose of any such contention. Plaintiff had lost no rights by failure to do the annual assessment work; that failure gave the government no ground of forfeiture. Wilbur v. U.S. ex rel. Krushnic, supra."

Thirdly, it was held that the Saving Clause (Section 37 of the Leasing Act) preserved all rights acquired prior to the enactment of the act, and that the reservation did not enlarge the Department's authority. On this it said:

> "In this view, plaintiff came directly within the exception. The government invokes the new policy of the Leasing Act abolishing the practice of location. But the saving provision of section 37 is a part of the policy of the act. Its terms explicitly declare the will of Congress as to valid existing claims, with full understanding of the status of such claims under the prior law.

> "The government refers to the reservation in the opinion in Wilbur v. U. S. ex rel. Krushnic, supra, as to the maintenance of a claim by a resumption of work 'unless at least some form of challenge on behalf of the United States to the valid existence of the claim has intervened.' But that was a reservation, not a decision, and it does not aid the government in its contention here. To be effective, the 'challenge' to the 'valid existence' of a claim must have some proper basis. No such basis is shown.

The Court's conclusion was that "the Department's challenge, its adverse proceedings, and the decision set forth in the bill went beyond the authority conferred by law."

Soon after the decision of the Supreme Court in Virginia-Colorado, the Department issued its opinion in The Shale Oil Company, 55 I.D. 287 (1935). This in a sense implemented the Supreme Court's ruling. The appeal to the Secretary was from a Commissioner's denial of patent application. The contention was that the Land Department was without jurisdiction and without legal authority to question a placer claim owner's failure to perform assessment work for any year. The First Assistant Secretary reversed the decision and remanded the case with instructions to reinstate the application and to dispose of it unaffected by default in the performance of assessment labor. In commenting on the Virginia-Colorado opinion the Assistant Secretary noted that "the challenge to the valid existence of the claims had no proper basis; and that the Department's challenge, its adverse proceedings and the decision set forth in the Bill went beyond the authority conferred by law."

The Assistant Secretary went even further; he concluded that: "The above-mentioned decisions in the cases of Francis D. Weaver and Federal Oil Shale Company and other departmental decisions in conflict with this decision are hereby overruled."

Thus, the Department not only clearly recognized its lack of authority to deal with the assessment work problem in the case before it, but also it cleared the record by overruling all prior inconsistent decisions.

There are other evidences that this was and continued to be the viewpoint of the Department many, many years following the Virginia-Colorado decisions. The viewpoints of various officials, reflected in the correspondence, show that they believed that prior decisions forfeiting claims for failure to do assessment work were void.[3]

---

[3] Letter of Secretary Lane dated October 23, 1918:

> "I am in receipt of your letter dated October 2, 1918, and making inquiry as to the necessity for performing annual assessment work on some oil shale lands in Wyoming, which you and associates are claiming under placer mining locations made in 1917 and 1918.
>
> * * * * *
>
> "As a general rule matters involving questions of assessment work on mining claims arise between adverse claimants to the same mineral land and go only to the right of possession, the determination of which is committed exclusively to the courts."

Letter of First Assistant Secretary Vogelsang dated January 20, 1919:

> "The annual expenditure on unpatented mining location required under Section 2324 U.S. Revised Statutes, and commonly called annual assessment work, is, with the exception of certain phosphate locations affected by a special act of Congress, solely a matter between rival or adverse claimants to the same mineral land, and goes only to the

The regulations governing the Bureau of Land Management recognize this proposition also. See 43 C.F.R. § 3420.4 (1966). It provides:

> "The annual expenditure of $100 in labor or improvements on a mining claim, required by section 2324 of the Revised Statutes (30 U.S.C. § 28), is, with the exception of certain phosphate placer locations, validated by the act of January 11, 1915 (38 Stat. 792; 30 U.S.C. 131), under which regulations were issued March 31, 1915 (Circ. 396), 44 L.D. 46, solely a matter between rival or adverse claimants to the same mineral land, and goes only to the right of possession, the determination of which is committed exclusively to the courts."[4]

---

3 (Continued)
right of possession, the determination of which is committed exclusively to the courts. In other words, the non-performance of assessment work renders the land subject to adverse relocation provided work is not resumed (40 Stat. 343).

Letter from Commissioner Fred W. Johnson dated June 28, 1935:

> "It is possible if you left your claims in 1925 and have not since performed assessment work thereon that they have been relocated, but as also stated in the paragraph referred to, 'The determination of the question of the right of possession between rival or adverse claimants to the same mineral land is committed exclusively to the court.' Matters of trespass, thievery, etc., such as those referred to in your letter, are also committed to the jurisdiction of the court, being punishable only under the laws of the state. As this office has no jurisdiction in the matters mentioned in your letter it will not undertake to advise you in that regard."

Letter from Commissioner Johnson dated July 25, 1935:

> "Replying to your letter of July 20, 1935, you are advised that this office has no jurisdiction over questions relating to the performance of annual assessment work on mining claims, such questions being committed exclusively to the courts."

Letter from Under Secretary Chapman dated February 11, 1946:

> "The failure to perform the annual assessment work for the benefit of a valid mining location has no effect as against the United States but only renders the claim subject to loss through relocation

Similarly, the annual reports of the Secretary of the Interior also reflected the Department's view in this regard.[5] Moreover, the commentators have generally regarded the question as one of jurisdiction.[6]

Union Oil Company Decision

We turn now to consideration of the case which marked a reversal of the Department's viewpoint and attitude. In Union Oil a number of applicants for patents to oil shale placer mining claims which had been declared null and void in the contest proceedings during 1930-1933 sought to have patents issued. The Manager

---

3 (Continued)

by another claimant if the work is not commenced or resumed before such relocation. Therefore, the question of whether the work done is of a nature that would be considered assessment work is not one within the jurisdiction of this Department but is for the appropriate court to determine should litigation arise between the claim holder and another claimant making a relocation of the same ground. See Ickes v. Virginia-Colorado Development Corp., 295 U.S. 639.

See also, The Shale Oil Company, supra, pp. 20-21.

[4] See also 37 L.D. 757, 769 (1909); 49 L.D. 15, 73 (1922) showing similar versions of the quoted regulation.

[5] See Report of the Secretary of the Interior, Fiscal Year 1934, page 65, and see also the Statement of Secretary Wilbur before the Senate Committee on Public Lands, given on February 12, 1931.

[6] E.g.:
"Assessment work upon oil-shale claims is governed by the rules of the general mining law and the claimant of a valid location prior in time to the passage of the Leasing Act is not subject to any forfeiture that did not apply to such law. In other words, fulfillment of the annual ownership work each year is not a prerequisite to continuing ownership as against the Government of the United States, and, in the absence of an adverse relocation, work may be resumed at any time." Division of Mines, California Department of Natural Resources, American Mining Law, Vol. 1, § 1051 (1943);

of the Land Office denied these efforts. The Secretary, in his exercise of supervisory jurisdiction, submitted the case to the Solicitor of the Department for final decision. The Manager's decision was, of course, affirmed notwithstanding that the Solicitor recognized the invalidity of the 1930-1933 rulings. He noted that failure to perform annual assessment work was not a ground for cancellation of oil shale placer claims by the Government. 71 I.D. at 170. He held, however, that even though the original cancellations were incorrect in law, that nevertheless under the principles of finality of administrative action, estoppel by adjudication, and res judicata, these rulings could not be challenged in the year 1962.

The Solicitor's basic assumption in the Union Oil decision was that the Supreme Court had not denied the Department's jurisdiction with respect to the subject matter. He also construed The Shale Oil Company case, supra, which had overruled all inconsistent decisions, as not reinstating the claims previously declared forfeited. In essence, he determined that the applicants were required to take action to nullify these rulings at the time and that their failure to exercise this initiative constituted something in the nature of an implied acquiescence. The important emphasis in the decision was placed on administrative finality and res judicata. Since this decision stands

---

6 (Continued)

> "Only a mining relocation can affect forfeiture, and the Federal Government cannot question the failure to perform assessment work." 2 American Law of Mining, § 7.26 (1964).

in the way of a recognition of the plaintiffs' rights, we must consider and determine its validity in the light of the Supreme Court decisions and the narrow question is whether the Department had subject matter jurisdiction with respect to performance or nonperformance of assessment work. In support of his holding that there was such jurisdiction, the Solicitor pointed to the language in *Virginia-Colorado* to the effect that the Secretary had authority by appropriate proceedings to determine that a claim was invalid for lack of discovery, fraud, or other defect, or that it was subject to cancellation by reason of abandonment. From this he concluded that the Department at all times retained jurisdiction; that is, power over these claims. As we view it, this was an unjustified interpretation of the decisions of the Supreme Court. It overlooked the basic nature in terms of property of a mining location. Both *Krushnic* and *Virginia-Colorado* proceeded on a fundamental proposition that this creates a vested property right which can be defeated only by a competitor. Historically, this was the nature and character of the mining claim, and to overlook it is to change a fundamental rule of property. No amount of administrative legerdemain can overcome this fundamental principle.

It is, of course, so fundamental as to require no documentation, that an adjudication by a tribunal lacking subject matter jurisdiction is wholly nugatory, need not be appealed, and can not be *res judicata*. When, as here, the Department acted beyond the authority granted to it by the law, it acted in the particular

area beyond its jurisdiction. The Supreme Court told the Department this in language as plain as legal language can be. If *Krushnic* left some unresolved question, *Virginia-Colorado* did not. It is clear from a reading of this opinion that the Court was speaking on the question of the Department's jurisdiction. As to pre-1920 locations, the Court held that they retained the legal status which they had enjoyed prior to the adoption of the Leasing Act. Both of these cases rule that prior to the adoption of this Act the performance of assessment work was unnecessary to the preservation of the locator's possessory right against the Government.

Virginia-Colorado clarified beyond question the proposition that the Government has never had a possessory right to pre-Leasing Act mining claims defective only for failure to perform assessment work. It follows from this that the Department is wholly without jurisdiction to inquire into the status of assessment work performance.

It is also noteworthy that there has been no contention here that plaintiffs have abandoned their claims and there is a dearth of evidence to establish acquiescence, express or implied, by plaintiffs in any assumption of jurisdiction by the Department.

It follows, therefore, that the decision in *Union Oil* is contrary to and irreconcilable with the decisions of the Supreme Court of the United States. In so holding we recognize that the Department of the

Interior is in good faith advancing a policy. Congress has, of course, granted the Department broad powers to protect public lands and the Department undoubtedly considers itself duty-bound to oppose the instant claims. This Court, however, must follow the law as laid down by the Supreme Court of the United States. It is upon this basis that we conclude that the actions of the Department in assuming jurisdiction over the failure to do assessment work is void and of no effect whatever.

The plaintiffs are directed to submit forms of judgments reflecting the views expressed in this opinion. These judgments should be submitted to defendant for approval as to form.

DATED at Denver, Colorado, this Twenty-first day of December, A. D. 1966.

BY THE COURT:

WILLIAM E. DOYLE, Judge
United States District Court

UNITED STATES

DEPARTMENT OF THE INTERIOR

NEWS RELEASE

OFFICE OF THE SECRETARY

For Release January 27, 1967

FIVE-POINT OIL SHALE DEVELOPMENT PROGRAM ANNOUNCED

Secretary of the Interior Stewart L. Udall today announced a five-point action program to promote economic recovery of shale oil and associated minerals from the rich oil shale resources of the Green River Formation in Colorado, Wyoming and Utah. It is estimated that known oil shales of the area contain the equivalent of about 70 times the present domestic proved reserves of crude petroleum.

Steps leading to the program announced by the Secretary began in 1964 with the appointment of a distinguished group of private citizens to the Oil Shale Advisory Board. The Board's interim report, presented to the Secretary in February 1965, has been the subject of intensive and detailed review within the Interior Department during the past two years.

The Secretary pointed out that mounting energy demands in the United States made it increasingly important to develop oil shale to the point where it can begin to make a contribution to meeting U. S. energy needs.

The Secretary explained that the five-point program will involve the following:

-- Action to clear title to public oil shale bearing lands of the three-state area. This will involve withdrawal of oil shale lands from all mineral entry other than for oil and gas leases, the initiation of examinations and contests to remove clouds on title arising from oil shale and other mineral claims, and restoration of sodium to withdrawn status except where the Secretary specifically finds that particular sodium deposits can be extracted without damage to the oil shale resource. Pending sodium preference right lease applications will be promptly considered on their merits.

-- A "blocking-up program" in which the Secretary will give consideration to applications from private owners of scattered oil shale lands to exchange part of them for Federal lands of similar quality as to mineral and other physical characteristics. The purpose of these exchanges would be to permit some consolidation of private holdings which are at present too scattered for efficient mining operations. Under this program the Secretary will consider applications for blocking only where the applicant agrees to a time schedule and investment commitments for the development of economic mining and recovery operations. Applicants will also be required to agree to develop the blocked up lands in accordance with the best conservation principles, both with regard to maximizing the mineral values to be recovered and to minimizing damage to the environment.

-- As the third point of the Department's oil shale program the Secretary will announce procedures which will permit the Department to consider applications from individual firms and combinations of firms for provisional developmental leases of oil shale lands. Under this part of the program, it is contemplated that the Department will contract with interested parties for a variety of approaches to the development of economic processes for the recovery of oil and associated minerals from shale. Applications for contracts would describe the process sought to be developed, a commitment of research and development expenditures, a time schedule within which these expenditures would be made, and the approximate volume and location of oil shale and associated minerals required to support operation of a commercial plant if the research and development project is successful. Parties to such contracts will be permitted access to the necessary acreage of oil shale lands for testing purposes, but leases for larger tracts for commercial development will not be issued until the research and development contract has been successfully performed. Leases will contain firm assurances that a commercial scale plant will be constructed, and that good conservation practices will be observed in the commercial operation.

-- A fourth program will seek to enlist the Atomic Energy Commission and private capital with the Department of the Interior to find ways to retort the oil from the shale in situ. Underground atomic explosions will be researched as a means of fracturing deep deposits of shale, and making possible the retorting of the shale without ever bringing it to the surface. Such a program, if found technically and commercially feasible, would go far toward solving the difficult problems of protecting the landscape of the Green River Formation area from the scars of traditional mining and processing of minerals. The organic matter (kerogen) present in the rock formation known as oil shale is a solid that is converted to a liquid by heating. The concept of underground retorting is that the shale first should be broken into small pieces by a massive explosion. Thereafter heat would be applied to the broken shale, and the liquid oil pumped to the surface.

-- Finally, the Department will request funds for a broad program of research and investigation by the Geological Survey, Bureau of Mines, and Bureau of Land Management. Some of these research projects will involve close cooperation and joint participation with other Federal agencies, industry and public and private research facilities. Objectives of this part of the program will include the development of more information on the location, characteristics, and values of the oil shale and other mineral resources of the Green River Formation, and of better technology for resource development consistent with sound principles of conservation and environmental control.

"A major concern in developing the oil shale program," the Secretary said, "has been to enunciate policies and procedures that will protect the public interest fully, and at the same time will offer reasonable incentives to private capital to participate in an accelerated research and development program.

"The public interest requires," he said, "that in our efforts to develop the technology of extracting oil from shale, we write into every rule, regulation, contract, and permit affecting the public lands those terms and conditions that will:

-- Encourage competition in development and use of oil shale and related mineral resources;

-- Prevent speculation and windfall profits;

-- Promote mining operation and production practices that are consistent with good conservation management of overall resources in the region;

-- Encourage fullest use of all known mineral resources;

-- Provide reasonable revenues to the Federal and State Governments.

"We intend," the Secretary said, "to seek the broadest possible participation in the development of our oil shale resources. The public lands in the region, representing the largest untapped source of hydrocarbon energy known to the world, belong to all of the people and must be used for the benefit of all the people."

The Secretary emphasized that the contracts involved in Point 3 of the oil shale program will involve two distinct phases. The first phase, in which the contractor expends research and development funds, will require only small acreages of public lands necessary for research and development operations. The second phase, reached only when the research and development work has proved successful, will require acreages large enough to assure an adequate supply of oil shale and other minerals for a commercial operation of specified capacity over an agreed term of years.

Total Federal holdings of oil shale lands approximate seven million acres, but these holdings vary widely as to the richness and thickness of the shale.

"I do not underestimate the difficulties that will attend all five parts of our program," the Secretary said. "For at least 50 years legal, economic, and technical difficulties have stood in the way of efforts to develop the Nation's oil shale resource. To bring this program to fruition may take more than a decade, but if we are to realize the potential of our vast oil shale resources we must undertake intensive efforts now."

Although oil shale deposits are found in several States, the richest deposits are found in the Green River Formation of Colorado, Utah and Wyoming. It is in this area where the Department anticipates the greatest interest under Point 3 of its program.

The amount of oil that can be recovered will depend upon technology and economics. The Green River deposits extend over about 16,000 square miles and include several geologic basins. The total thickness ranges from a few hundred feet to more than 2,000 feet and the potential oil yield ranges from a few gallons to more than 65 gallons per ton of shale. The Federal Government has title to about 72 percent of the total oil shale acreage with potential yield of at least 15 gallons per ton; this amounts to about 79 percent of the estimated equivalent oil in place. Some of this acreage, however, is the subject of mining claims not yet adjudicated. The remaining acreage is owned by the States or private individuals or companies.

The Bureau of Land Management will today submit an application for a withdrawal order and the Department will begin to take the other steps necessary to clear title to the Federal oil shale lands.

Proposed regulations setting forth the terms and conditions under which the Department will administer the oil shale program should be promulgated within sixty to ninety days.

X X X

89763

COPY OF THE JANUARY 26, 1967 APPLICATION FOR WITHDRAWAL OF LANDS CONTAINING OIL SHALE:

March 3, 1849

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
WASHINGTON, D.C. 20240

IN REPLY REFER TO:
720
3170

JAN 26 1967

Memorandum

To: Land Office Managers, Cheyenne - Denver - Salt Lake

From: Director

Subject: Application for withdrawal of deposits of oil shale and lands containing oil shale deposits.

Pursuant to the regulations in 43 CFR, Subpart 2311, I hereby make application for withdrawal of the lands described below. The information required by 43 CFR 2311.1-1 is as follows:

1. Applicant and Using Agency -- U. S. Bureau of Land Management, Washington, D. C. 20240.

2. Legal Description -- All deposits of oil shale and all lands containing such deposits in Colorado, Utah, and Wyoming which are owned by the United States and which are under the administrative jurisdiction of the Department of the Interior.

3. Sections 1-3, Act of February 28, 1958, are not applicable.

4. Acreage -- The gross acreage approximates 10,000,000 acres and the net public acreage approximates 7,000,000 acres.

5. Purpose -- Protection and multiple-use development of the minerals and other resources in the lands.

6. Contamination -- One objective of the proposal is to permit control and minimization of contamination which may result from development of the resources of the lands.

7. Period of Withdrawal -- The withdrawal would continue in effect until terminated or modified by the Secretary. The withdrawal would be revoked in whole or in part at such times that facts show that retention of the withdrawal would be inconsistent with its purposes.

8. Operation of the Public Land Laws and Regulations -- The withdrawal would withdraw, subject to valid existing rights, the lands and deposits from appropriation under the mining laws insofar as they apply to metalliferous minerals and would also withdraw them from sodium leasing except where the Secretary finds that development of the sodium deposits would not adversely affect in any significant way the oil shale values of the lands.

9. Water -- The applicant does not intend to acquire rights to the use of water in conformity with State laws and procedures.

10. Justification -- Oil shale as a potentially valuable resource has long been recognized as is evidenced by Executive Order No. 5327, which placed these lands in a reserve for the purpose of investigation, examination, and classification, pending development of technically and economically feasible methods of extraction.

The oil shale was formed in large, shallow fresh water lakes and occurs in the Green River formation in several sedimentary basins in the three States. The largest concentration of oil shale occurs in the Piceance Creek Basin of Colorado, where oil shale in the center of the Basin is up to 2,000 feet thick. Also in the center of the Basin in the oil shale section, a saline phase has been found. In this saline zone nahcolite (sodium bicarbonate), dawsonite (a basic sodium-aluminum carbonate), and other sodium minerals and possibly other minerals have been or may be found. It is quite possible that other Basins may also contain dawsonite.

The nahcolite and dawsonite are closely associated and apparently found with the oil shale and disseminated in the oil shale. The minerals appear to be so intimately mixed that recovery of one without mining or adversely affecting the other minerals may not be possible.

Applications for preference right sodium leases have been filed for eight permits covering approximately 20,000 acres. There are 84 pending applications for sodium prospecting permits in Colorado and Utah. Further leasing for sodium is undesirable until legal and technical problems are clarified. 1/

After the announcement of discovery of the dawsonite, the holders of the sodium permits and applications and others located placer mining claims. Over 5,000 mining claims covering about 750,000 acres had been recorded in the county records. Reportedly, very few of the claims have a physical exposure of mineral.

The existence of dawsonite raises other problems regarding development. Leasable minerals (sodium and oil shale) are reserved. However, because of the physical nature of the deposit, recovery of the aluminum without disturbance and possible damage to the other minerals may not be feasible. Multiple mineral development may require special legislation.

Sound resource management would seem to dictate multiple-mineral development. In order to protect the resource, and to enable us to initiate development of the resource under sound conservation principles, and to develop proper management plans for orderly development based upon more complete information, it is necessary to prevent further mining locations and leasing of sodium.

1/ As used in this context, the term "leasing" means the issuance of (1) permits, or (2) leases.

11. Authority for Withdrawal -- Implied authority of the President delegated by him to the Secretary of the Interior in Executive Order No. 10355 of May 28, 1952.

Those areas known to be subject to this proposal are shown on the maps prepared by the Geological Survey for the effective implementation of Executive Order No. 5327 of April 15, 1930, as modified by Departmental Order (13752065) of November 28, 1955. This proposal also applies to deposits of oil shale, and lands containing them within the States of Wyoming, Utah, and Colorado, even though such deposits or lands may not be depicted on such maps.

12. Pursuant to 43 CFR 2311.1-2, the noting of this application on the records of the land office operates to segregate the oil shale deposits, and lands containing them, from appropriation as set forth in paragraph numbered 8.

Boyd L. Rasmussen

Enclosure
Draft of W/D Order

Approved: JAN 26 1967

/S/ Harry R. Anderson

Secretary of the Interior

IN REPLY REFER TO:

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
WASHINGTON, D.C. 20240

720 (3170)

RECEIVED
FEB 3 1967

JAN 3 0 1967

Mr. T. Hendrickson
Chief Metallurgist
Cameron and Jones, Inc.
2150 South Bellaire Street
Denver, Colorado 80222

Dear Mr. Hendrickson:

Your letter of January 12 requested a copy of my order "ordering that sodium prospecting permits and leases not be granted on oil shale lands."

Actually, I did not issue such an order. All I did was remind our field officers that sodium leases and permits could not be issued without prior approval of this office. This practice is necessary because of problems related to the relationship of sodium deposits to oil shale.

Sincerely yours,

John O Crow
Associate Director

1 Enclosure
Encl. No. 1 12/21/66 memo

COPY of Memorandum of December 21, 1966 from John Crow, Assistant Director of the Bureau of Land Management, to State BLM Directors concerning permits and leases for sodium:

DEC 21 1966

Memorandum

To: State Directors, Colorado, Wyoming and Utah

From: Assistant Director, Lands and Minerals

Subject: Sodium Leases and Prospecting Permits in Oil Shale Areas

This is to confirm previous instructions that sodium leases and prospecting permits in oil shale areas should not be issued without the prior approval of this office. If necessary, applications can be sent to this office for review. It is not expected that any extended delay will result in the review of any cases sent for review.

The purpose of this review is to prevent a recurrence of the complications caused by issuance of prospecting permits in the center of Piceance Creek Basin, Colorado. Any applications submitted for review should include information on the estimated thickness and grade of oil shale involved, on the relationship to the sedimentary basin involved, and on the sodium mineralization known in the area.

John O. Crow
Acting

COPY OF NOTICE OF PROPOSED WITHDRAWAL OF OIL SHALE LANDS:

(Filed on Page 1058 of the Federal Register, Volume 32, Number 19, January 28, 1967.)

UTAH, WYOMING, AND COLORADO

Notice of Proposed Withdrawal and Reservation of Lands

The Bureau of Land Management has filed an application for withdrawal of the lands described below, from (1) appropriation under the mining laws relating to metalliferous minerals, and (2) from sodium leasing except where the Secretary finds that development of the sodium deposits would not adversely affect in any significant way the oil shale values of the lands. The applicant desires the withdrawal to protect the multiple-use development of the minerals and other resources in the lands.

For a period of 30 days from the date of publication of this notice, all persons who wish to submit comments, suggestions, or objections in connection with the proposed withdrawal may present their views in writing to the undersigned officer of the Bureau of Land Management, Department of the Interior, Washington, D.C. 20240.

If circumstances warrant, a public hearing will be held at a convenient time and place, which will be announced.

The determination of the Secretary on the application will be published in the FEDERAL REGISTER. A separate notice will be sent to each interested party of record.

The lands involved in the application are: **All deposits of oil shale and all lands containing such deposits in the States of Colorado, Utah, and Wyoming which are owned by the United States and which are under the administrative jurisdiction of the Department of the Interior.**

BOYD L. RASMUSSEN,
Director.

JANUARY 26, 1967.

[F.R. Doc. 67-1118; Filed, Jan. 27, 1967; 10:25 a.m.]

FROM THE NATHAN REPORT, THE POTENTIAL MARKET FOR
MIDWESTERN AND ALASKAN COAL AND LIGNITE

L. Recommendations

The realization of the estimated market potential for Midwestern coal and lignite assumes actions on the part of both Government and industry to promote this objective. It is clear that coal faces a major competitive threat in the electrical utility market unless extraordinary measures are taken to reduce mine costs, transport costs, and generation costs. Our recommendations are addressed to the problem of expanding the production and use of Midwestern coal and lignite resources, some of which have significant economic potential, and are an important part of the energy resources of the United States. To some extent, the development of these resources requires the solution of problems confronting the coal industry as a whole.

Recommendations are directed to Government and industry because it is only through the separate and joint efforts of both that the optimum use of Midwest coal resources can be achieved.

Industry Action

1. Electric utilities should explore the opportunities identified in this study for the economic supply of electricity from Midwest coal and lignite.

2. The steel industry should explore the economic and technical advantages of greater use of the high quality metallurgical coal resources of Oklahoma.

3. The coal industry must be able and prepared to make substantial, long-term investments in large mines employing modern, low-cost production techniques.

4. The coal industry must further be prepared to take advantage of opportunities for cost-saving practices which are known to exist, but have not previously been exploited.

5. The coal equipment manufacturing industry should accelerate research and development of more advanced equipment, and its adaptation to less favorable mining conditions.

6. The railroads serving Midwest coal sources should review existing tariff structures in the light of the potential volume markets identified in this report, and the need for reduction in costs at all stages, from production through transport and utilization.

7. The coal, electrical utility, and equipment manufacturing industries should support private research programs and cooperate with Governmental programs aimed at

    a) improving the technology and reducing the costs of limiting air pollution from coal-burning plants;

    b) reducing the capital investment cost and increasing the efficiency of conventional generating plants;

    c) the development of new, more efficient energy conversion technology, such as magneto-hydrodynamics and electro-gas dynamics.

8. The coal industry should cooperate with the Government in a program designed to improve the quality, reliability, and completeness of official reports on U.S. coal resources.

Government Action

9. Increased emphasis should be given to the support of research programs aimed at enhancing the market prospects for coal and lignite, including particularly those mentioned in 7 above.

10. The determination and evaluation of the nature and extent of U.S. coal resources by the Federal and state Governments should be refined and improved so as to increase the reliability and economic usefulness of published reports on the subject. This would require the adoption of geological criteria which would lend themselves to more meaningful economic judgments; greater access to and use of information in private hands; and, where necessary, more direct exploration in order to bring the range of uncertainty about reserves within more reasonable limits. Consideration should be given to joint efforts with the coal industry in this direction.

FROM THE NATHAN REPORT, THE POTENTIAL MARKET FOR
MIDWESTERN AND ALASKAN COAL AND LIGNITE

TABLE I-1

ESTIMATED POTENTIAL MARKETS FOR MIDWEST COAL AND LIGNITE IN 1980, COMPARED WITH ACTUAL CONSUMPTION IN 1964

(Millions of Tons)

Source and Market	Estimated 1980	Actual 1964
1. Electrical Utilities, Total	49.8	6.4
North Dakota Lignite	14.3	1.7
Oklahoma Coal	6.5	-
Texas Lignite	26.0	-
Iowa, Kansas, Missouri Coal	3.0	4.7 ①
2. U.S. Steel Industry, Total	2.0	0.6
Oklahoma	2.0	0.6
3. Foreign Steel Industry, Total	1.0	2/
Oklahoma	1.0	2/
4. U.S. Manufacturing Industry, Total	3.0	1.6
Arkansas-Oklahoma 3/)	-	0.2
Missouri, Kansas, Oklahoma)	3.0	0.8
North and South Dakota)	-	0.6
5. Grand Total	55.8	8.6
North Dakota Lignite	14.3	N.A.
Oklahoma Coal	9.5	N.A.
Texas Lignite	26.0	N.A.
Iowa, Kansas, Missouri Coal	3.0	N.A.
Unidentified	3.0	-

1/ Excludes unreported consumption for electricity generation for Aluminum Company of America at Rockdale, Texas.

2/ Exports to Mexico of 54,000 tons assumed to be for the steel industry.

3/ Includes coal from Alabama, Georgia, and Tennessee.

TABLE I-2

ESTIMATED SHARE OF MIDWEST COAL AND LIGNITE IN FUEL CONSUMPTION FOR THERMAL POWER GENERATION OF SELECTED MIDWEST STATES, 1980

(Thousands of tons coal equivalent)

State	Total Thermal Requirement	Midwest Share of Market	
		Source	Quantity
North and South Dakota, Minnesota	18,847	North Dakota	8,000
Arkansas, Oklahoma	17,404	Oklahoma	6,500
Iowa, Kansas, Missouri	40,348	Iowa, Kansas, Missouri	3,000
Texas	66,813	Texas	15,000
Total	143,412		32,500

Note: Coal is assumed to be 25 million B.t.u. per ton; thermal requirements for power generation assume a heat rate of 9,000 B.t.u./Kwhr.

FROM THE NATHAN REPORT, THE POTENTIAL MARKET FOR MIDWESTERN AND ALASKAN COAL AND LIGNITE

TABLE I-3

COAL RESERVES OF THE UNITED STATES
JANUARY 1, 1960

(Millions of Short Tons)

	Remaining Reserves January 1, 1960 (1)	Recoverable Reserves, January 1, 1960 Assuming 50 percent Recovery (2)
East of Mississippi	483,244	241,662
Far West	576,365	288,184
Midwest		
North Dakota Lignite	350,718	175,359
South Dakota Lignite	2,031	1,015
Iowa	28,446 1/	14,223 1/
Missouri	78,788 2/	39,394
Kansas	20,748	10,374
Oklahoma	3,313	1,656
Arkansas	2,424	1,212
Texas Lignite	14,880	7,440
Total Midwest	501,348	250,673
Total United States	1,560,957	780,479

1/ Remaining and recoverable reserves in Iowa were estimated at 6,524 and 3,262 million tons in a more recent study: Coal Resources of Iowa, E. R. Landis and O.J. Van Eck, Iowa Geological Survey, 1965.

2/ The remaining reserves in Missouri were estimated at 23.5 billion tons in a recent unpublished study.

Source: Paul Averitt, Coal Reserves of the United States - A Progress Report, January 1, 1960, Geological Survey Bulletin 1136

TABLE I-4

TREND OF PRODUCTION OF BITUMINOUS COAL AND LIGNITE AVERAGE OUTPUT PER MAN-DAY AND AVERAGE VALUE AT THE MINE IN THE MIDWESTERN STATES

1) Production, Thousands of Net Tons
2) OMD - Tons
3) Average Value Per Ton at Mine in Dollars

		1945	1950	1960	1961	1962	1963	1964
North Dakota (Lignite)	1)	2,522	3,261	2,525	2,726	2,733	2,399	2,637
	2)	14.73	22.32	36.93	40.57	42.05	37.29	47.25
	3)	1.56	2.38	2.29	2.25	2.24	2.19	2.15
South Dakota	1)	24	N.A.	20	18	18	17	13
	2)	6.30	N.A.	10.10	11.97	11.84	11.34	14.43
	3)	2.17	N.A.	4.08	4.20	4.30	3.74	4.85
Iowa	1)	2,045	1,891	1,068	927	1,130	1,213	973
	2)	3.99	5.99	11.58	12.55	12.99	15.15	12.95
	3)	3.51	3.69	3.60	3.58	3.56	3.50	3.54
Missouri	1)	3,983	2,963	2,890	2,938	2,896	3,175	3,253
	2)	8.88	9.78	10.88	11.45	19.87	26.49	29.53
	3)	2.59	4.17	4.31	4.28	4.16	4.16	4.08
Kansas	1)	3,229	2,125	888	664	915	1,169	1,263
	2)	8.63	11.58	16.70	15.10	17.30	20.49	20.57
	3)	2.57	3.87	4.73	4.67	4.64	4.54	4.55
Arkansas	1)	1,853	1,169	409	395	256	221	212
	2)	3.60	4.53	8.39	7.53	8.44	9.34	10.49
	3)	5.05	7.60	7.61	7.31	7.07	6.82	7.08
Oklahoma	1)	2,909	2,679	1,342	1,032	1,048	1,008	1,028
	2)	5.82	6.49	9.14	8.93	10.50	14.57	18.50
	3)	3.61	5.44	6.79	6.58	6.66	4.63	5.32
Texas	1)	80	18	N.R.	N.R.	N.R.	N.R.	N.R.
	2)	19.52	4.62	N.R.	N.R.	N.R.	N.R.	N.R.
	3)	.85	1.69	-	-	-	-	-
Midwest	1)	16,645	14,106	9,142	8,700	8,996	9,202	9,379
	2)	6.58	8.69	13.5	14.2	18.6	22.1	24.7
	3)							
Illinois	1)	73,011	56,291	45,977	45,246	48,487	51,736	55,023
	2)	9.06	9.75	21.94	23.73	24.66	26.02	27.13
	3)	2.34	4.05	4.00	3.91	3.86	3.80	3.79
Kentucky	1)	69,593	78,496	66 846	63,032	69,212	77,350	82,747
	2)	5.22	6.39	13 86	15.21	16.12	17.03	18.40
	3)	3.00	5.01	4.22	4.06	3.91	3.82	3.75
West Virginia	1)	152,035	144,116	118,944	113,070	118,499	132,568	141,408
	2)	5.57	6.41	12.07	12.99	13.57	14.44	15.31
	3)	3.20	5.23	5.02	4.94	4.88	4.79	4.90
United States	1)	577,617	516,311	415,512	402,977	422,149	458,928	486,998
	2)	5.78	6.77	12.83	13.87	14.72	15.83	16.84
	3)	3.06	4.84	4.69	4.58	4.48	4.39	4.45

N.A. - Not Available Separately
N.R. - Not Reported

Source: U.S. Bureau of Mines, Minerals Yearbook

FROM THE NATHAN REPORT, THE POTENTIAL MARKET FOR
MIDWESTERN AND ALASKAN COAL AND LIGNITE

TABLE IV-2

NUMBER OF MINES AND PRODUCTION OF CLASS 1 BITUMINOUS COAL AND LIGNITE MINES FOR SELECTED STATES, 1964

	Total Number of Mines	Class 1 Mines (500,000 tons and over annual output) Number	Per Cent	Production	Per Cent
North Dakota a/	29	1	3.5	895,285	33.9
South Dakota a/	1	-	-	-	-
Iowa	34	-	-	-	-
Missouri	20	4	20.0	2,786,329	85.6
Kansas	7	1	14.3	899,416	71.2
Arkansas	11	-	-	-	-
Oklahoma	16	-	-	-	-
Total Midwest	118	6	-	2,581,030	-
Illinois	102	34	33.3	47,240,673	85.8
Kentucky	2,002	31	1.5	41,549,675	50.2
West Virginia	1,743	81	4.6	83,238,019	58.9
United States	7,630	238	3.1	267,362,530	54.9

---

a/ Lignite

Source: U.S. Department of Interior, Bureau of Mines Minerals Yearbook, 1964

NATIONAL WESTERN MINING CONFERENCE
DENVER, COLORADO
FEBRUARY 11, 1967

MINING CLAIMS AND AN OIL SHALE PROGRAM: THE GOVERNMENT'S SEARCH FOR INDUSTRY UNDERSTANDING

BY

FRANK J. BARRY

ON JANUARY 27, 1967, THE SECRETARY OF THE INTERIOR ANNOUNCED A FIVE-POINT PROGRAM FOR THE DEVELOPMENT OF OIL SHALE RESOURCES IN THE GREEN RIVER FORMATION IN COLORADO, WYOMING AND UTAH. THE OVERALL PURPOSE OF THIS PROGRAM IS FIRST TO ACHIEVE A MULTIPLE-MINERAL TECHNOLOGY THROUGH PUBLIC AND PRIVATE RESEARCH AND THEN TO CONSIDER THE ESTABLISHMENT OF AN INDUSTRY OR INDUSTRIES TO DEVELOP THESE MINERALS. POINT ONE OF THIS PROGRAM COMMITS THE DEPARTMENT TO ACTION CALCULATED TO CLEAR TITLE TO OIL SHALE BEARING LANDS. I WOULD LIKE TO DISCUSS THE SIGNIFICANCE OF THIS ACTION IN TERMS OF THE PARTICULAR CLAIMS INVOLVED AND TO PLACE IT IN THE CONTEXT OF THE DEPARTMENT'S ONGOING RESPONSIBILITIES.

ABOUT 30,000 OIL SHALE PLACER MINING CLAIMS WERE LOCATED PRIOR TO PASSAGE OF THE MINERAL LEASING ACT IN 1920. MANY OF THESE CLAIMS HAVE BEEN PATENTED, BUT THE VAST MAJORITY REMAIN AS CLOUDS ON TITLE TO THE LAND. APPROXIMATELY 400,000 ACRES OF PUBLIC LAND IN THE PICEANCE CREEK BASIN AND ADJACENT AREAS IN COLORADO ARE COVERED BY SUCH CLAIMS.

ON APRIL 17, 1964, THE SECRETARY OF THE INTERIOR ISSUED A DIRECTIVE THAT ADMINISTRATIVE CONTESTS BE INITIATED AGAINST SOME OF THE PRE-1920 CLAIMS TO ESTABLISH THE LEGAL PRECEDENTS BY WHICH THE VALIDITY OF ALL THE UNPATENTED OIL SHALE CLAIMS COULD BE DETERMINED. STEPS ARE NOW WELL UNDERWAY TOWARD THE ACTUAL HEARING OF THESE CONTESTS SOMETIME THIS SPRING. IT HAS LONG BEEN KNOWN THAT A DETERMINATION OF THE VALIDITY OF OUTSTANDING UNPATENTED MINING CLAIMS IS INDISPENSABLE TO ANY PROGRAM FOR OIL SHALE DEVELOPMENT.

SUCH DETERMINATION OF MINING CLAIM VALIDITY IS NECESSARY IN ORDER TO SETTLE TITLE TO THE LAND. A PROGRAM FOR THE DEVELOPMENT OF A PUBLIC RESOURCE WILL, OF COURSE, BE ENTIRELY DIFFERENT THAN ONE FOR THE DEVELOPMENT OF A PRIVATE RESOURCE. NO SIGNIFICANT PLANS OF RESEARCH AND DEVELOPMENT OF ANY MINERAL RESOURCES CAN BE CARRIED OUT WHERE THE LEAST DOUBT EXISTS AS TO SURFACE OR SUBSURFACE LEGAL RIGHTS AND INTERESTS. INVESTMENTS

CANNOT BE ATTRACTED FOR RESEARCH NOR CAN LEASES BE ISSUED WHERE THE GOVERNMENT CANNOT ENSURE CLEAR TITLE TO ITS LANDS. THE PROBLEM OF UNPATENTED MINING CLAIMS, THEREFORE, REPRESENTS A SUBSTANTIAL BARRIER TO EXTENSIVE RESEARCH AND SYSTEMATIC DEVELOPMENT OF THE MULTIPLE MINERAL RESOURCES OF THE AREA.

LATE IN MARCH OF LAST YEAR A NEW SERIES OF CLAIMS WERE LOCATED IN THE SAME REGION FOR THE RECENTLY DISCOVERED SODIUM MINERAL, DAWSONITE, A SODIUM-ALUMINUM CARBONATE. THROUGHOUT THE SUMMER, CLAIMS WERE LOCATED AT THE RATE OF SEVERAL HUNDRED PER WEEK. BY THE END OF AUGUST, ESSENTIALLY ALL THE FEDERAL LAND IN THE PICEANCE BASIN NOT COVERED BY OIL SHALE CLAIMS--APPROXIMATELY 500,000 ACRES--WAS COVERED BY AN ESTIMATED 3,500 NEW CLAIMS. IN ADDITION, ABOUT 1,740 CLAIMS COVERING ABOUT 250,000 ACRES HAVE BEEN LOCATED FOR OIL SHALE LANDS IN THE RICHEST PARTS OF THE UINTA BASIN IN UTAH.

IN SEPTEMBER 1966, AT LEAST 1700 CLAIMS COVERING ABOUT 250,000 ACRES WERE LOCATED, REPORTEDLY FOR PLATINUM, IN THE SAND WASH BASIN IN MOFFAT COUNTY, COLORADO. EARLY IN 1966, NUMEROUS CLAIMS WERE LOCATED IN THE OIL SHALE AREA OF WYOMING. LOCATION NOTICES STATED THAT THESE CLAIMS WERE LOCATED FOR GOLD AND OTHER MINERALS. AT LEAST 1,000 OF THESE CLAIMS, INVOLVING ABOUT 150,000 ACRES, HAVE BEEN LOCATED.

ALL TOLD, APPROXIMATELY 8,000 CLAIMS INVOLVING OVER A MILLION ACRES ARE KNOWN TO HAVE BEEN LOCATED IN THE THREE-STATE OIL SHALE AREA IN 1966. ALMOST ALL ARE PLACER CLAIMS, LOCATED BY LEGAL SUBDIVISIONS. AN ASSOCIATION OF TWO TO EIGHT INDIVIDUALS CAN LOCATE A PLACER CLAIM OF FROM 40 TO 160 ACRES. PLACER CLAIMS HAVE THE FOLLOWING CHARACTERISTICS:

1. NO DIFFICULT AND EXPENSIVE SURVEY IS REQUIRED;
2. ONLY ONE DISCOVERY IS REQUIRED FOR EACH ASSOCIATION CLAIM, WHICH MAY BE AS LARGE AS 160 ACRES;
3. ONLY $100 OF ASSESSMENT WORK IS REQUIRED FOR EACH ASSOCIATION CLAIM;
4. ONLY $500 WORTH OF IMPROVEMENTS ARE REQUIRED FOR PATENTING OF AN ASSOCIATION CLAIM.

APART FROM THE NORMAL COMPLICATIONS ARISING FROM ADMINISTRATION OF THE MINING LAWS, ADDITIONAL PROBLEMS ARE CREATED WHERE MINERALS OF VARYING LEGAL STATUS ARE

INTIMATELY INTERMINGLED AND WHERE LARGE NUMBERS OF CLAIMS AND VAST ACREAGES ARE INVOLVED. UNDER THE MINING LAW, A MINING CLAIM, IF VALID, REPRESENTS A PROPERTY RIGHT AND, THEREFORE, IS PROTECTED BY THE DUE PROCESS PROVISIONS OF THE CONSTITUTION. THIS MEANS THAT THE VALIDITY OF A CLAIM CAN ONLY BE TESTED BY A NOTICE TO THE CLAIMANTS AND AN OPPORTUNITY TO BE HEARD. AN ELABORATE LEGAL PROCEDURE HAS BEEN DEVELOPED FOR DETERMINING THE VALIDITY OF CLAIMS TO PROTECT THE RIGHTS OF CLAIMANTS.

THE DUE PROCESS CLAUSES OF THE FIFTH AND FOURTEENTH AMENDMENTS ARE AMONG THE MOST CHERISHED GUARANTEES IN OUR CONSTITUTION BUT A RESOLUTION OF TITLE PROBLEMS FOR UNPATENTED MINING CLAIMS IN THE OIL SHALE LANDS WILL THEREBY BE SLOWED DOWN. IT WILL BE NO SMALL TASK TO INVESTIGATE AND PROSECUTE UP TO 40,000 MINING CLAIM CONTESTS.

EVEN THOUGH A PARTICULAR CLAIM MAY REPRESENT A MERE PAPER LOCATION, THESE LEGAL PROCESSES MAY HAVE TO BE EXHAUSTED BEFORE RIGHTS ARE FINALLY DETERMINED, SINCE ALL CLAIMANTS ARE ENTITLED TO THEIR "DAY IN COURT." THEREFORE, A FULL-SCALE PROGRAM INVOLVING GOVERNMENT AND INDUSTRY COOPERATION TO DEVELOP THE MINERAL RESOURCES IN THE OIL SHALE LANDS IS SUBSTANTIALLY DEPENDENT UPON THIS INITIAL STEP OF CLEARING TITLE AT LEAST TO LANDS IMMEDIATELY REQUIRED FOR EXPERIMENT AND PILOT DEVELOPMENT.

THE DIFFICULTIES INVOLVED IN ELIMINATING INVALID CLAIMS ARE ILLUSTRATED BY THE FOLLOWING PROCEDURES:

1. EACH CLAIM IS EXAMINED CAREFULLY ON THE GROUND BY A PROFESSIONAL MINING ENGINEER OR GEOLOGIST AND A RECORD MADE OF THE FACTS;
2. IF THE CLAIM IS BELIEVED INVALID, CONTEST PROCEEDINGS ARE INITIATED BY SERVING A COMPLAINT ON ALL PERSONS HAVING AN INTEREST IN THE CLAIM. HOWEVER, IDENTIFICATION OF SUCH PERSONS MAY PRESENT MAJOR PROBLEMS. TITLE TO UNPATENTED CLAIMS MAY PASS BY DEED OR BY PROBATE OR OTHER JUDICIAL PROCEEDINGS. TITLE MAY PASS WITHOUT RECORD WHERE A LOCATOR DIES AND HIS ESTATE IS NEVER PROBATED. THE LAW REQUIRES THAT EVERY REASONABLE EFFORT BE MADE TO FIND AND SERVE THE PARTIES IN INTEREST BEFORE RESORT IS HAD TO SERVICE BY PUBLICATION. IF A LAWYER UNDERTAKES THE TASK OF REMOVING A CLOUD FROM THE TITLE OF A SINGLE CITY LOT, HE HAS PROBLEMS ENOUGH. WHEN WE ARE CONTESTING FORTY THOUSAND CLAIMS, THE PROBLEMS SEEM INSURMOUNTABLE.

EACH CONTEST WILL REQUIRE A DIFFICULT SEARCH--MANY TIMES MORE DIFFICULT IN THE CASE OF 50-YEAR-OLD CLAIMS--SINCE THE ADDRESSES AND IN SOME CASES, EVEN THE NAMES, OF THE CLAIMANTS ARE NOT OF RECORD. THE LAW DOES NOT REQUIRE ANY NOTICE TO THE FEDERAL GOVERNMENT OF THE CLAIM OR OF CHANGES IN TITLE THERETO OVER THE YEARS. THIS INFORMATION MUST BE SOUGHT BY EXPENSIVE AND TIME CONSUMING TITLE SEARCHES.

CO-LOCATORS MAY BE SCATTERED AROUND THE COUNTRY OR EVEN AROUND THE WORLD. WITH THE PASSAGE OF TIME, LOCATORS MAY MOVE OR DIE, AND CURRENT ADDRESSES OF LOCATORS, OR THEIR SUCCESSORS IN INTEREST, MUST BE SOUGHT. PERSONAL OR REGISTERED MAIL SERVICE MUST BE USED WHEREVER POSSIBLE. ONLY AFTER A FAIR DILIGENT SEARCH AND A FAILURE TO LOCATE CLAIMANTS MAY SERVICE BY PUBLICATION BE MADE.

3. IF ANY OF THE CLAIMANTS ANSWER THE COMPLAINTS ON TIME, AN ADMINISTRATIVE PROCEDURE ACT HEARING BEFORE A HEARING EXAMINER IS HELD. SUCH HEARINGS, AS YOU KNOW, ARE CONDUCTED VERY MUCH LIKE HEARINGS IN COURT. WITNESSES ARE CALLED, EXAMINED AND CROSS-EXAMINED; DOCUMENTARY EVIDENCE IS IDENTIFIED, OFFERED, ARGUED ABOUT, ADMITTED OR EXCLUDED. THE CASE IS ARGUED BY BOTH SIDES, SOMETIMES IN LENGTHY WRITTEN BRIEFS AND A DECISION IS MADE. SUCH PROCEEDINGS ARE THE LIFE OF LAWYERS AND LITIGANTS, BUT WHEN YOU THINK OF FORTY THOUSAND CLAIMS, IT IS GOING TO TAKE A LONG TIME.
4. EITHER PARTY MAY APPEAL TO THE DIRECTOR OF THE BUREAU OF LAND MANAGEMENT FROM AN ADVERSE DECISION. MORE BRIEFS WILL BE FILED. IF THE DIRECTOR'S DECISION IS ADVERSE TO THE CLAIMANTS, AN APPEAL MAY BE TAKEN TO THE SECRETARY OF THE INTERIOR. A FINAL DEPARTMENTAL DECISION MAY THEN BE CHALLENGED IN THE FEDERAL COURTS. MANY YEARS MAY PASS BEFORE A FINAL DECISION IS REACHED IF ALL THESE APPELLATE PROCEDURES ARE EXHAUSTED.

THE COSTS INVOLVED IN DETERMINING THE VALIDITY OF CLAIMS VARY GREATLY. A COMPLEX CASE INVOLVING IMPORTANT ISSUES MAY COST THE GOVERNMENT AND THE CLAIMANTS MANY THOUSANDS OF DOLLARS PER CLAIM. EVEN WHERE MANY CLAIMS ARE CONTESTED TOGETHER, THE COST PER CLAIM MAY AMOUNT TO MORE THAN ONE HUNDRED DOLLARS. ASSUMING THIS LATTER FIGURE, APPROXIMATELY $800,000 WOULD BE REQUIRED TO DETERMINE THE VALIDITY OF THE RECENTLY LOCATED CLAIMS IN THE OIL SHALE AREAS.

THIS SUMMARY OF THE MINING CLAIM SITUATION IN THE THREE-STATE OIL SHALE REGION INDICATES THE MAGNITUDE OF THE PROBLEM FACING THE DEPARTMENT IN ATTEMPTING TO PROMOTE RESEARCH AND, POTENTIALLY, DEVELOPMENT OF THE MULTIPLE RESOURCES AVAILABLE. IT WOULD BE ENTIRELY ERRONEOUS TO ASSUME, HOWEVER, THAT THE GOVERNMENT WILL SACRIFICE DUE PROCESS OR ESTABLISHED ADMINISTRATIVE PROCEDURES IN THE INTEREST OF FURTHERING AN OIL SHALE PROGRAM. IF MINING CLAIMS ARE VALID UNDER THE LAW, THEY WILL BE RECOGNIZED; IF INVALID, THEY WILL BE REJECTED.

I HAVE OUTLINED THE PROBLEMS FACING THE DEPARTMENT REGARDING THESE MINING CLAIMS SO THAT YOU MAY BETTER UNDERSTAND WHAT LIES AHEAD IN THE DEVELOPMENT OF THE VAST RESOURCES IN THE OIL SHALE REGION. IT IS IMPORTANT FOR YOU AND OTHERS LIKE YOU TO APPRECIATE THE REASONS WHY GOVERNMENT MOVES AS IT DOES.

WE IN THE DEPARTMENT OF THE INTERIOR HAVE SOLEMN TRUST AND STEWARDSHIP RESPONSIBILITIES DELEGATED TO US BY CONGRESS. WE ARE TRUSTEES. A TRUSTEE IS A FIDUCIARY, THAT IS, ONE TO WHOM PROPERTY IS LEGALLY COMMITTED IN TRUST. THIS RESPONSIBILITY OBLIGATES US TO ADMINISTER THE PUBLIC ESTATE FOR THE USE AND BENEFIT OF ALL THE PEOPLE OF THE UNITED STATES. OUR DUTY IS TO SERVE THE PUBLIC INTEREST AS SPELLED OUT BY CONGRESS. ANY DEVIATION FROM THIS DUTY FOR OUR OWN OR ANY OTHER PURPOSE WOULD BE BOTH UNCONSCIONABLE AND ILLEGAL. SUBJECT TO THE MANDATE OF CONGRESS, THE PUBLIC TRUSTEE IS RESPONSIBLE FOR THE SAFEKEEPING OF PUBLIC PROPERTY AND FOR ITS DISPOSITION IN ACCORDANCE WITH LAW.

AS A COROLLARY OF THIS OBLIGATION, THE PUBLIC OFFICIAL IS ALSO A STEWARD. ACCORDING TO ANCIENT SCOTTISH TRADITION THE STEWARD WAS AN OFFICER OF THE HIGHEST DIGNITY AND TRUST. HE ADMINISTERED THE CROWN REVENUES, SUPERINTENDED THE AFFAIRS OF THE HOUSEHOLD, AND POSSESSED THE PRIVILEGE OF HOLDING THE FIRST PLACE IN THE ARMY, NEXT TO THE KING, IN THE DAY OF BATTLE. I AM SURE, BY THE WAY, THAT TO MANY STEWARDS THIS CAME TO BE A DUBIOUS PRIVILEGE. WE ARE ALSO AWARE, HOWEVER, OF THE HISTORICAL FACT THAT FROM THE OFFICE OF STEWARD THE ROYAL HOUSE OF STUART TOOK ITS NAME AND BECAUSE IT OVERREACHED AND ABUSED ITS AUTHORITY, IT EVENTUALLY FELL FROM POWER.

STEWARDSHIP RESPONSIBILITIES IMPLY A MORE ACTIVE ROLE THAN THAT OF TRUSTEESHIP. DEPARTMENTAL OFFICIALS HAVE A DUTY TO GO BEYOND MERE MAINTENANCE OF THE STATUS QUO. THEY MUST DEVISE PRACTICAL POLICIES FOR THE DEVELOPMENT OF THOSE RESOURCES NECESSARY TO THE NATION'S WELL-BEING. WHEN DEVELOPMENT IS DESIRED, INACTION MUST BE SHUNNED. INDUSTRY OFTEN CONSIDERS INACTION A ONE-WAY STREET--THAT IS, THE GOVERNMENT WITHHOLDING RESOURCES WHICH IT SEEKS. HOWEVER, PRIVATE INTERESTS CAN ALSO BE GUILTY. WIDESPREAD MINING CLAIMS, ABANDONED OR HELD FOR MANY YEARS WITHOUT DEVELOPMENT, CAN CONSTITUTE A SUBSTANTIAL HINDRANCE TO A DEVELOPMENTAL PROGRAM.

TOO OFTEN THOSE SEEKING TO REAP THE PUBLIC'S NATURAL RESOURCE BOUNTY HAVE LOOKED UPON THE GOVERNMENT--IN THIS CASE THE DEPARTMENT OF THE INTERIOR--AS AN ADVERSARY MERELY CONTENT TO OBSTRUCT, DELAY AND DENY. THIS IS AN OVER-GENERALIZATION BASED UPON RELATIVELY SCATTERED EVIDENCE AND REPRESENTS A FUNDAMENTAL MISUNDERSTANDING OF THE DEPARTMENT'S ROLE.

SOME HAVE RECENTLY SAID THAT THE FEDERAL GOVERNMENT MAY TAKE SWEEPING STEPS TO VOID MINING CLAIMS OR DENY RIGHTS. AN IMPLICATION IS LEFT THAT THIS MAY BE DONE SUMMARILY AND ARBITRARILY. SUCH SUGGESTIONS DO NOT CONTRIBUTE TO UNDERSTANDING BETWEEN GOVERNMENT AND INDUSTRY. THE FEDERAL GOVERNMENT IS NEITHER AN ENEMY NOR AN ALLY OF ANY PRIVATE INTEREST. IT IS BOTH AN UMPIRE AND A PARTICIPANT IN THE ADMINISTRATION OF THE MINING LAWS. ON THE ONE HAND, IT HAS RESPONSIBILITY FOR DETERMINING THE VALIDITY OF MINING CLAIMS--ACCORDING TO DULY ESTABLISHED PROCEDURES WHICH ENSURE FAIRNESS. ON THE OTHER HAND, IT HAS STATUTORY RESPONSIBILITY, DELEGATED BY REPRESENTATIVES OF ALL THE PEOPLE, FOR THE PROMOTION OF INTELLIGENT AND TIMELY PROGRAMS TO DEVELOP THE PUBLIC RESOURCES. WITH SPECIFIC REGARD TO THE RECENTLY ANNOUNCED OIL SHALE PROGRAM, THE DEPARTMENT WILL BE CALLED UPON TO PERFORM THESE DUAL FUNCTIONS OF DISPASSIONATE ADJUDICATION AND RESOURCE PROMOTION. SUCCESSFUL COMPLETION OF THESE TASKS WILL DEPEND TO A DEGREE ON THE SUPPORT AND UNDERSTANDING OF PRIVATE INDUSTRY. WE DO NOT EXPECT ALL OUR ACTIONS TO BE SYMPATHETICALLY RECEIVED, BUT WE EXPECT THEM TO BE FAIRLY JUDGED BY THE ENTIRE NATION. WE ARE WILLING TO ACCEPT ITS JUDGMENT.

MUCH HAS BEEN SAID ABOUT GOVERNMENT'S ALLEGED LACK OF DIRECTION AND INITIATIVE. YET THIS IS A TWO-EDGED SWORD. INDUSTRY PESSIMISM AND MISTRUST ARE EVIDENCED IN

STATEMENTS SUCH AS THOSE RECENTLY MADE IN AN OIL INDUSTRY TRADE JOURNAL EDITORIAL WHICH CAUTIONED READERS NOT TO EXPECT MUCH FROM THE DEPARTMENT'S OIL SHALE PROGRAM SINCE, IT SAYS, ONLY "LIP SERVICE" IS GIVEN TO DEVELOPMENT BY PRIVATE ENTERPRISE. VARIOUS INDUSTRY REPRESENTATIVES HAVE OFTEN DRAWN LINES OF COOPERATION NARROWLY AND HAVE DRASTICALLY LIMITED THE ACCEPTABLE RULES UNDER WHICH THE BALL GAME SHOULD BE PLAYED. THUS, THIS SAME JOURNAL BEMOANS THE FACT THAT "SO MANY STRINGS ARE ATTACHED THAT THE GOVERNMENT WILL HAVE CLOSE CONTROL." THIS STATEMENT COMES, I MIGHT POINT OUT, A FULL FIVE MONTHS BEFORE GOVERNMENT'S CONDITIONS--IN THE FORM OF REGULATIONS--HAVE BEEN ANNOUNCED. AND ANYWAY, IT IS HARDLY CONSTRUCTIVE TO SUGGEST THAT PUBLIC PROPERTY WILL BE TURNED OVER TO PRIVATE INDUSTRY WITHOUT CONDITIONS TO ASSURE THAT THE PUBLIC WILL BENEFIT. INDUSTRY AS WELL AS GOVERNMENT MUST RESIST THE TEMPTATION TO RELY ON TRADITIONAL STEREOTYPES IN THINKING OF THE OTHER.

WHETHER WITH MINING CLAIMS ON OIL SHALE LANDS OR ANY SIMILAR PROBLEM, IT IS A FUNDAMENTAL MISUNDERSTANDING OF THE ROLE OF THE FEDERAL GOVERNMENT AND ITS AGENCIES TO ATTRIBUTE TO THEM A BIAS TOWARD OR AGAINST CERTAIN INTERESTS. THE RESPONSIBILITIES OF THE DEPARTMENT DO NOT PERMIT THE LUXURY OF BEING "PRO-MINING INDUSTRY" OR "ANTI-OIL INDUSTRY," "PRO-RECLAMATION" OR "ANTI-DEVELOPMENT." BELIEFS OF THIS SORT SPRING FROM THE APPLICATION OF PRIVATE MOTIVES AND ATTITUDES TO PUBLIC OFFICIALS. POLICY IS SHAPED ON THE BASIS OF THE PUBLIC INTEREST, THAT IS, WHAT MOST NEARLY APPROXIMATES THE GOOD FOR ALL THE PEOPLE, INCLUDING FUTURE GENERATIONS. PETTY FAVORITISMS OR BIASES DO NOT AND SHOULD NOT FORM ANY PART OF THIS POLICY-SHAPING PROCESS.

THEREFORE, ANNOUNCEMENTS OF DEPARTMENTAL DECISIONS TO ADJUDICATE MINING CLAIMS AND CLEAR TITLE TO OIL SHALE LANDS SHOULD NOT BE LOOKED UPON AS A THREAT OR AN EFFORT TO FRUSTRATE PROGRESS, BUT AS A FIRST STEP IN THE EVOLUTION OF A COHERENT OIL SHALE PROGRAM. AS I HAVE ALREADY POINTED OUT, THIS WILL BE A LONG AND COSTLY PROCESS. IT IS EXPECTED THAT AN APPROACH SIMILAR TO THAT NOW UNDERWAY INVOLVING OIL SHALE CLAIMS WILL ALSO BE USED TO DETERMINE THE VALIDITY OF RECENT LOCATIONS FOR DAWSONITE AND OTHER MINERALS. SPECIFIC CLAIMS WHICH WILL MOST ADEQUATELY RAISE ALL RELEVANT ISSUES WILL BE SELECTED AND CONTESTED. ANY FINAL DEPARTMENTAL OR JUDICIAL DETERMINATIONS WOULD THEN, WE HOPE, OPERATE AS A PRECEDENT TO DETERMINE THE VALIDITY OF THE BULK OF THE REMAINING CLAIMS.

THIS FIRST STEP IN AN EXTENSIVE EFFORT TO UNLOCK THE RESOURCES IN THE OIL SHALE REGION IS A STEP FORWARD NOT A STEP BACK. IT MUST BE CONSTRUED AS PART OF AN OVERALL ATTEMPT TO SETTLE TITLE TO THESE POTENTIALLY RICH LANDS WITH SOME FINALITY SO THAT REAL PROGRESS CAN BE MADE. IN THIS AND IN OTHER, FUTURE STEPS, IT IS MOST IMPORTANT FOR YOU AND MEMBERS OF RELATED INDUSTRIES TO REMEMBER THE WORDS OF A FORMER OUTSTANDING PUBLIC SERVANT, HENRY L. STIMSON. HE SAID:

> GOVERNMENT IS NOT A MERE ORGANIZED POLICE FORCE, A SORT OF NECESSARY EVIL, BUT RATHER AN AFFIRMATIVE AGENCY OF NATIONAL PROGRESS AND SOCIAL BETTERMENT.

* * * * *

To House Vote, Yes.........No.........; Sent back to Senate..........................Date..............................
Senate Vote, Yes..........No..........; on Final Passage, Yes.........No.........Date..............................
Signed by President.............................. Speaker.............................. Governor..............................
Referred to Committee on..
Reported Out as..
Vote, 2nd Reading, Yes.........No.........; 3rd Reading, Yes.........No.........Date..............................

Mineral and Grazing Leases

1967

S. B. No. 77 **By Messrs. Bunnell, Bullen, Welch**

AN ACT AMENDING SECTIONS 65-1-7, 65-1-63 *AND* 65-1-75, *UTAH CODE ANNOTATED* 1953; 65-1-18, *UTAH CODE ANNOTATED* 1953, *AS AMENDED BY CHAPTER* 132, *LAWS OF UTAH* 1959; 65-1-44, *UTAH CODE ANNOTATED* 1953, *AS AMENDED BY CHAPTERS* 131 *AND* 132, *LAWS OF UTAH* 1959, *AS AMENDED BY CHAPTER* 166, *LAWS OF UTAH* 1963; 65-1-45, *UTAH CODE ANNOTATED* 1953, *AS AMENDED BY CHAPTER* 132, *LAWS OF UTAH* 1959, *AS AMENDED BY CHAPTER* 167, *LAWS OF UTAH* 1963; 65-1-87, 65-1-90, 65-1-93 *AND* 65-1-96, *UTAH CODE ANNOTATED* 1953, *AS ENACTED BY CHAPTER* 132, *LAWS OF UTAH* 1959; *RELATING TO MINERAL AND GRAZING LEASES; TERMS; ROYALTIES; RANGE IMPROVEMENT; CONVERSION OF EXISTING MINERAL LEASES; POWERS OF THE STATE LAND BOARD; AND REPEALING SECTIONS* 65-1-6, *UTAH CODE ANNOTATED* 1953; 65-1-5, 65-1-19, 65-1-20 *AND* 65-1-21, *UTAH CODE ANNOTATED* 1953, *AS AMENDED BY CHAPTER* 132, *LAWS OF UTAH* 1959; 65-1-86, 65-1-88, 65-1-89, 65-1-91, 65-1-94, *AND* 65-1-95, *UTAH CODE ANNOTATED* 1953, *AS ENACTED BY CHAPTER* 132, *LAWS OF UTAH* 1959.

Be it enacted by the Legislature of the State of Utah:

Section 1. Section 65-1-7, Utah Code Annotated 1953, is amended to read:

65-1-7. The board shall cause the state to be properly represented in all suits, actions, controversies or claims relating to state

lands provided that upon the request of the board the attorney general or under his direction any district attorney, county attorney, shall institute and prosecute the necessary action or proceedings for the enforcement of any of the provisions of this title. No [other] counsel shall be employed therefor except with the approval of the governor and the attorney general.

Section 2. Section 65-1-18, Utah Code Annotated 1953, as amended by Chapter 132, Laws of Utah 1959, is amended to read:

65-1-18. The state land board may issue mineral leases including without limitation oil, gas and hydrocarbon leases for prospecting, exploring, developing, and producing [oil and gas, or for prospecting and mining purposes, upon any portions of the unsold lands or mineral interests of the state.] minerals covering any portions of the state lands or the reserved mineral interests in state lands. [More than one outstanding valid lease for the same purpose shall not be issued by the state land board upon the same land.] The land board may issue multiple leases on the same lands at the same time, but the board shall not issue more than one outstanding lease for the same purpose upon the same land. [Oil and gas leases shall be issued pursuant to law providing therefor. Leases for property and mining purposes shall be issued for such annual rental not less than fifty cents per acre per annum, and for such royalty upon the product as the state land board may deem fair and in the interest of the state. Such rental paid for any year shall be credited against the royalties as they accrue for the year. Prospecting and mining leases, unless sooner canceled pursuant to the terms of the lease instrument, shall run for such a period as may be determined by the lessor, but in no case for less than ten years next succeeding the first day of the year within which the lease is granted.] All mineral leases issued by the board shall contain such terms and provisions as the board deems to be in the best interest of the state and shall provide for such annual rental and for such royalty as the land board shall deem fair and in the best interest of the state of Utah, but the annual rental

shall not be less than fifty cents per acre per annum. Mineral leases shall run for such terms as the land board shall provide, but such leases shall in no event be for a term for less than 10 years and so long thereafter as the mineral is produced in paying quantities. Applications for mineral leases shall be on such forms as the land board shall prescribe.

Section 3. Section 65-1-44, Utah Code Annotated 1953, as amended by Chapters 131 and 132, Laws of Utah 1959, as amended by Chapter 166, Laws of Utah 1963, is amended to read:

65-1-44. [Unless otherwise provided by law, all state lands administered by the land board shall be subject to lease at the actual leasing value thereof and for such terms as fixed by the board, provided that grazing leases shall not be granted for terms exceeding twelve years nor in tracts exceeding 25,000 acres to any one person or corporation. When it shall be shown that a lease has been secured for the purpose of releasing, the board may declare such lease void. Application for lease shall be made to the board, and shall contain an affidavit that the applicant desires to lease for his own use and benefit. Applications for leases shall be accompanied by the fees provided by law. If the board deems it advisable to lease any land for purposes other than oil and gas, it shall cause the same to be appraised and determine the annual rental thereon, and shall thereupon notify the applicant thereof, and upon receipt of the first installment of rental, a lease of land applied for, duly executed, shall be delivered to the lessee. The first payment upon the lease shall be to the 1st day of January next ensuing. Subsequent payments shall be due and payable in advance, on the 1st day of January of each year. In leasing grazing lands, the board shall give preference to actual settlers and citizens. The board may withhold from sale or lease lands on which there are springs of water, where water for stock purposes is scarce and their sale or lease, if enclosed, would, in the opinion of the board, create a monopoly of large tracts of the United States or state grazing lands in favor of the purchases (purchasers) or lessees of lands on which such springs or streams are located.] The land board shall have the power to issue surface grazing leases on state-owned lands; the leases to be on such terms and conditions as the board shall deem to be necessary in the best interests of the state of Utah provided, however, no such lease shall be for a term in excess of fifteen years. The board shall promulgate rules and regulations pertaining to the leasing of state-owned lands for grazing purposes, such regulations to prescribe the form of application, the form of lease, and the basis for computation of annual rentals.

Section 4. Section 65-1-45, Utah Code Annotated 1953, as amended by Chapter 132, Laws of Utah 1959, as amended by Chapter 167, Laws of Utah 1963, is amended to read:

65-1-45. Except as otherwise provided [by law,] herein applications to lease [shall be considered in the order filed; provided, that when simultaneous applications are filed the land board shall let the land to the applicant who will pay the highest rental therefor; and provided further, that applications to lease land already under lease, shall not be received before the day following the expiration of said lease, and all such applications received on such day shall be considered simultaneous.] state lands for mineral purposes shall be considered in the order in which they are filed. The land board shall have the authority to withdraw state lands from leasing but unless state lands are withdrawn and except or otherwise provided herein, the land board shall lease the land to the first qualified applicant who has filed an application in accordance with rules and regulations promulgated by the land board.

In all cases where lands become available for leasing by the [state] land board because they are newly acquired, or because [a previous] an existing mineral lease is canceled, relinquished, surrendered, or [otherwise terminated by the board, such lands shall be offered for mineral lease.] for any reason terminates, the land board shall offer the land for subsequent mineral leasing by the following procedure only:

(a) [Within sixty days after such acquisition or termination,] A notice of the lands having so become available for leasing shall be posted in the state land office. The notice shall describe the land, indicate what mineral interest in each tract is available for leasing and state the last date, which shall be fifteen days after the notice is posted, on which bids will be received.

(b) Except as provided in subsection (c), all applications for the lease of such lands filed before the closing date stated in the notice shall be considered to have been filed simultaneously. Such applications shall be submitted in sealed envelopes and shall be opened in the land office at ten o'clock on the morning of the first business day following the last day on which bids are receivable. The land board shall award leases to the highest responsible, qualified bidder in terms of the bonus paid in addition to the first year's rental who regularly submitted a bid in the manner required by this act. In all cases of identical bids of successful bidders, right to lease shall be determined by drawing. Drawings shall be participated in only by those among whom the right to lease is equal, but shall be accomplished publicly at the state land board office.

(c) At the discretion of the land board, [leases for minerals other than oil and gas] mineral leases may be offered at public auction upon such terms, conditions, and minimum bid as may be prescribed by the board.

(d) Following the awarding of leases to successful bidders, all deposits except filing fees made by unsuccessful bidders shall be returned. [Two copies of the lease shall be sent to each successful bidder, who will be required to execute them within thirty days from receipt thereof and file bond if required. If a bidder, after being awarded a lease, fails to execute it or otherwise comply with applicable laws and regulations, his deposit will be forfeited and disposed of as other receipts under this act.]

The foregoing provisions of this section shall not apply to lands administered by the state land board in the beds of navigable lakes

and streams.

Section 5. Sections 65-1-63 and 65-1-75, Utah Code Annotated 1953, are amended to read:

65-1-63. [The state land board is authorized to join on behalf of the state of Utah in co-operative or unit plans of development or operation on (of) oil and gas pools with the United States government and its lessees or permittees and others in such form as may be acceptable to it, to modify or amend the same from time to time as in its judgment it may deem advisable, to consent to and approve the designated participating area and any extension or contraction thereof and to do all acts and things which it considers necessary or advisable to make operative such unit plan or plans; and for such purposes it is hereby authorized with the consent of its lessees or permittees to modify and change any and all terms of leases issued by it to facilitate the efficient and economic production of oil and gas from the lands under its jurisdiction; provided, however, that the said board shall not use or contract to use funds under its control for the purpose of drilling or otherwise paying the cost of development of oil and gas.] Lessees under mineral leases issued by the state land board are authorized, with the consent of the land board, to commit the state lands to unit, co-operative or other plans of development with other state lands, federal lands, privately owned lands, or Indian lands; and to implement such unitization, the land board is authorized with the consent of its mineral lessees or permittees to modify and change any and all terms of leases issued by it which are committed to such unit, co-operative or other plans of development.

65-1-75. The state land board may make surveys of any lands of the state which it may deem necessary to prevent and/or control floods and to conserve the natural resources of the state and to carry out properly the intent and purposes of this section; and surveys of all areas of the state where there have been damaging floods resulting in the loss of life or property and surveys of all areas where such damaging floods are likely to occur, and if after such surveys it appears to the satisfaction of the state land board that such floods are likely to occur in any locality, which will endanger life, health and/or property, then the state land board shall take [immediate] such action [such] as it may deem necessary to control and/or to prevent the occurrence of such floods. And for the purpose of controlling and preventing such floods it may co-operate with the people of the community affected thereby, the counties, cities or towns in which such floods are likely to occur, the state road commission, the federal government, railroads and any other persons, associations and corporations interested in the control and/or the prevention of such floods; and may construct or cause to be constructed such control works as it deems necessary, on such basis of participation as may be deemed equitable; and for these purposes may acquire any additional lands either by purchase, exchange, lease, condemnation, or gift necessary for the control and/or the prevention of such floods; and may transfer such lands to such agencies as may exist or hereafter be created to maintain such prevention and/or control works; and may employ or otherwise obtain the service of qualified engineers, foresters and rangemen; and may study flood-control problems and make recommendations to the governor and/or the legislature relative to their solution. [It shall be the duty of the state land board to co-operate with the sheriffs of the various counties in extinguishing and preventing fires on watershed lands, and for such purpose it may employ men to patrol watershed lands.] Whenever it appears to the satisfaction of the state land board that any watershed lands under either private, state or federal ownership are being made barren by overgrazing or any other cause, thereby creating a condition likely to cause floods, the state land board may co-operate with the federal government in acquiring the lands within the watershed thus affected, and may take such steps and action as it deems necessary and sufficient to prevent such lands from becoming barren so as to be the cause of floods. [, and] The state land board may

promote revegetation [of such lands] and range improvement of any of the state lands. The board may in its discretion limit the number and kind of stock that may be grazed each year on any state land leased for grazing purposes, and may [stipulate] regulate the number of days that such land may be grazed. The state land board may with the approval of the board of examiners expend funds from the state land board maintenance account to pay the costs of any of the activities contemplated by this section.

Section 6. Sections 65-1-87, 65-1-90, 65-1-93, and 65-1-96, Utah Code Annotated 1953, as enacted by Chapter 132, Laws of Utah 1959, are amended to read:

65-1-87. [Oil and gas] Mineral leases shall be issued only to applicants therefor who at the time of filing application and at the time of acceptance of application for lease by the state are either citizens of the United States, or associations of such citizens, or corporations organized under the laws of the United States or any state or territory thereof; provided, such association or corporation has fully complied with all of the laws of the state of Utah relative to qualification to do business within this state and is not in default under any such laws.

65-1-90. Upon violation by lessee of any lawful [condition of the lease,] provision in a mineral lease, the state land board may, at its option, cancel the lease after thirty days notice by registered or certified return receipt mail, unless the lessee remedies the violation or rectifies the condition within said thirty days or within such extension of time as the board may grant. [The] A mineral lessee shall have the right at all times to enter upon the leasehold for prospecting, exploring, developing, and producing [oil and gas,] minerals, and shall have reasonable use of the surface therefor; provided, [he] such lessee shall not injure, damage or destroy the improvements of the surface owner or lessee, and he shall be liable to and shall compensate such surface owner or lessee for all damage to the surface of said land and improvements, reasonable use ac-

cepted. Any such mineral lessee may occupy so much of the surface of [said] the leased land as may be required for all purposes reasonably incident to the exercise of lessees' rights under the lease; first, upon "securing" the written consent or waiver of the surface owner or lessee; or, second, upon payment for the damage to the surface of said land and improvements thereon to the surface owner or lessee thereof where agreement may be had as to the amount thereof; or, third, upon the execution of a good and sufficient bond to the state of Utah for the use and benefit of the surface owner or lessee of the land to secure the payment of such damages as may be determined and fixed by agreement or in action brought upon the bond or undertaking in a court of competent jurisdiction against the principal and sureties thereon, the bond to be in such form and amount as shall be prescribed by the state land board, and shall be filed with the board.

65-1-93. In respect to any [oil and gas] lease issued by the state of Utah, which shall give the lessee the right to produce gas, gas shall be deemed to be produced in paying quantities from any shut in gas well on the leased lands which is capable of producing gas in paying quantities whenever and at such times as such gas cannot be reasonably marketed at a reasonable price by reason of existing marketing or transportation conditions; provided, however, that lessee shall pay to the state an additional rental equal to the annual rental payable by such lessee under the terms of the lease, said rental to be paid on or before the annual rental paying date next ensuing after [the expiration of ninety (90) days from] the date said well was shut in, and on or before said rental date thereafter. Upon the commencement or marketing of gas from said well or wells, the royalty paid for the lease year in which the gas is first marketed shall be credited upon the rental payable as provided hereunder to the state for such year.

65-1-96. [Oil and gas leases in force on the effective date of this act which are in good standing but not in producing status on the date they would expire according to their terms are hereby extended so as to expire on the first day of the month following the anniversary date succeeding the date on which they would otherwise expire. Provided, however, that the rental for the period of extension shall be $1.00 per acre per year and shall be prorated for the period of the extension and provided further, that the state shall have no remedy against a lessee for failure to pay rental for the period of extension except cancellation of the lease.]

All mineral leases issued by the land board prior to the effective date of this act and in good standing on such date shall continue for the term specified therein and shall be subject to the conditions and provisions contained therein; provided, however, the land board may permit such lessees to convert such existing leases to the form of lease which shall be adopted by the land board pursuant to authority contained in this act, such conversion to be in accordance with rules and regulations promulgated by the land board.

Section 7. Sections 65-1-6, Utah Code Annotated 1953, 65-1-5, 65-1-19, 65-1-20 and 65-1-21, Utah Code Annotated 1953, as amended by Chapter 132, Laws of Utah 1959, 65-1-86, 65-1-88, 65-1-89, 65-1-91, 65-1-94 and 65-1-95, Utah Code Annotated 1953, as enacted by Chapter 132, Laws of Utah 1959, are hereby repealed.

No Planning Report Needed—Planning Committee

No Budget Report Needed.

STATEMENT OF SECRETARY OF THE INTERIOR STEWART L. UDALL BEFORE THE SENATE COMMITTEE ON INTERIOR AND INSULAR AFFAIRS CONCERNING CURRENT STATUS OF OIL SHALE RESOURCE DEVELOPMENT, FEBRUARY 21, 1967.

Mr. Chairman and Members of the Committee:

Two years ago this committee performed a very useful public service by conducting a seminar on the basic nature and character of the national oil shale resource. By providing that forum you were able to throw considerable light on a subject that has perplexed both the public resource managers and our mining and energy industries for half a century.

I do not think that any useful purpose would be served by repeating what was said on that occasion. Rather, I have looked upon your current invitation as a request for a briefing on more recent developments and our plans for moving ahead on this subject.

Two years ago we had to confess a considerable amount of ignorance on how this resource could be developed under existing statutory standards with adequate protection for the public interest. In terms of an actual leasing program open to all comers on a long-term basis, there are still many unresolved problems but we believe we have made good progress in analyzing the situation and in plotting a systematic course that will aid in the development and utilization of this valuable resource.

The results of this effort are reflected in a recent announcement of a five-point program. Some of the committee members and staff were briefed at the Department prior to release of our announcement. For purposes of review as well as convenience of other members, I should like to summarize the essential elements of that program.

First, we recognize that fifty years of uncertainty have given rise to legal questions about title to some of the lands involved. Prior to 1920, oil shale as well as conventional petroleum deposits had been locatable under the United States mining laws. Thousands of claims were filed on the Green River oil shale formation. Some of these went to patent in due course. Others were contested or rejected for failure on one ground or another to meet the standards of the mining law. But the vast majority have never been adjudicated. Many holders assert the continued validity of their claims. On many of them, the Government is equally adamant that they are invalid and should be formally cancelled. If the Government is right, the cloud on its title should be removed promptly so that development can proceed with confidence; if the claims are indeed valid, then the holders are entitled to a prompt decision and a clear title.

One aspect of this legal problem has already reached the courts. Over thirty years ago the Department cancelled a number of oil shale mining claims upon the ground that the claimants had failed to perform their annual assessment work. In a very large majority of cases the claimants accepted the Department's determination and did not appeal to the courts. One case, however, was carried to the Supreme Court by an aggrieved claimant. That Court held that failure to perform assessment work was not ground for cancellation. In the last few years applications for patents to the old cancelled claims have been made. The Department rejected these applications upon the ground that the claims had been cancelled in the earlier proceedings and, since the claimants had not appealed, the decisions were final and their validity could not be re-examined.

A short while after this decision, action was brought in the United States District Court in Colorado and that Court has recently rendered a judgment which will be entered this week, i.e., reversing the Department and ordering the reinstatement of the applications for patent. Since a large number of old claims will be affected by this judgment, we anticipate that further appellate review will be sought.

It is also the feeling of our legal staff that a large percentage of the old claims will not meet the tests of the mining law on other counts, such as discovery, proper monumentation of claims, and other essential requirements. These, too, will be brought to a prompt test, first through administrative adjudication, then through review in the courts if claims are cancelled and the claimants seek judicial review.

A second form of encumbrance has developed since your last hearings. As your record shows, the oil shale has been withdrawn since 1930. There was no desire at that time to forestall other mineral development consistent with protection of the oil shale. Accordingly, oil and gas and sodium leasing has been permitted. There are many oil and gas leases on the oil shale lands and their development and operation have not disturbed the oil shale deposits. The important Wyoming trona mining industry has also developed in the oil shale area. A dozen sodium prospecting permits were issued by BLM a few years ago. Explorations were made and dawsonite, a sodium aluminum carbonate, and nahcolite, a sodium carbonate, were found. It appears, however, that they are a part of and intermingled with the oil shale and that they cannot be developed without disturbing and possibly damaging the oil shale.

It is thought by many that the oil shale lands, although withdrawn, are open for location of deposits of metalliferous minerals under the mining law of 1872. A very large number of claims estimated to exceed 7000 have been filed in the last few months for dawsonite--on the theory the aluminum in dawsonite is locatable. For the most part dawsonite and nahcolite exist as an integral part of the oil shale deposits; they cannot be removed without removing the shale. The claims based on presence of dawsonite must be resolved before the oil shale resource can be made available for extensive development.

We have taken steps to resolve these title questions on a broad front. In the first place, application has been filed and published and is in process of consideration for the complete withdrawal of these lands from all forms of mineral entry or leasing, with the exception of deposits which are found by the Department to be extractable without damage to oil shale. Second, the Director of the Bureau of Land Management has initiated action on pending sodium lease applications to expedite decision on whether the leases should issue. Third, a series of immediate tests of the validity of dawsonite mining locations is being instituted.

This task of clearing away a half-century of legal underbrush will be time-consuming, vexatious and difficult. But it is a necessary prerequisite to the long-term development of the lands in question. In this connection, there is one way in which the Congress could be very helpful in simplifying the task.

As you know, there never has been and there is not at this time any general requirement that notice of a mining claim be filed with any Federal office or agency. Recordation in the land records of the county is all that is required and a search of those records must be made to determine whether Federal public lands are so encumbered. Our search of county records may not disclose the present address of the locator, nor assignments of the claim that he has made to third parties. We think that such information should also be a part of the land records of the Bureau of Land Management and that the locator or claimant should bear the burden of such a filing.

Undoubtedly there are hundreds of thousands of mining claims that have been recorded but have, in fact, been abandoned. Not only for the purposes of the oil shale programs but for orderly administration

in general, we urge that a recordation statute be enacted requiring that all past claims be recorded within a reasonable period (two or three years) and that all future claims or transfers be recorded currently. Assuming widespread publicity, this seems a reasonable and equitable way to eliminate a tremendous volume of potential work for our Federal land managers. We have proposed such legislation in the past and very shortly will transmit a new proposal for your consideration.

The second element of our program involves the blocking up of oil shale properties into efficient development units. One of the explanations advanced for failure to develop privately owned oil shale deposits is that they are either too scattered or not well located for mining operations. You may recall from the map which was reproduced in your 1965 hearing record that the private lands in the richest oil shale area of Colorado tend to stretch out into very narrow ribbons--usually following stream valleys.

Similarly, it would assist Federal management of public land oil shale deposits if isolated pockets of private land could be eliminated. Accordingly, we are proposing to undertake an extensive program of exchanging public for private lands with the primary objective of assembling manageable blocks for development purposes. Let me emphasize the "development" aspect of that objective. We fully intend, as a condition of the exchange, to require the private party to make definite development commitments. We do not propose to assist in the assembly of valuable properties for the purpose of speculation or hoarding of the oil shale resource.

It goes without saying, of course, that such exchanges could only be made on a value-for-value basis. Given the nature of this resource and our comparatively limited knowledge of it, this necessarily means that we would exchange only oil shale lands for oil shale lands.

The central core of this effort to get oil shale into the mainstream of the American economy is aimed directly at development of the resource itself. Two years ago we advised you that the Mineral Leasing Act of 1920 was the only authority that existed for this purpose and that we had doubts about its adequacy. We now believe, however, that Section 21 of that Act, as amended, is broad enough to permit the Department of the Interior to receive and act upon a number of the types of proposals contemplated by Point 3 of our Five-Point Program.

Accordingly, we are proposing to open small areas of oil shale lands to development on a test basis. Each area must be large enough to accommodate a prototype of actual production conditions. But in terms of the total area of Federal holdings, the acreage committed will be relatively small--the most limited that will accomplish the purpose. In essence we are proposing several development contracts, giving high priority to variety in the methods and techniques to be employed. Depending on performance results and what is learned from these contractual arrangements, the development contract may ripen into a lease for full-scale production on terms which must also evolve out of experience.

It is not possible at this time to specify how many such contracts will be made or their precise terms. Much will depend on industry's response to our invitation to submit applications. Our objective is to get the broadest kind of industrial participation, either through a number of individual companies or through joint ventures. In every instance, however, certain minimum requirements will be included in the public interest. A commitment of research and development expenditures, a time schedule for conducting such a program and access to resource and technological data will be among these. Heavy emphasis will also be placed on maximum recovery and development of all the minerals present--sodium and aluminum as well as shale oil.

In our public announcement of this development program it was indicated that implementing regulations would be prepared in 60 to 90 days. This appears to be on schedule, at least to the extent that such regulations will be released for public comment within that period. We will take particular care to secure and evaluate the views of the three States involved, since we are acutely aware that they have a deep interest in the subject and that their cooperation is essential to the adoption of total conservation measures.

If, after careful study of the development proposals submitted by industry or at any time thereafter, we conclude that new legislative authority or criteria are advisable, we shall recommrnd to the Congress the specific legislation required to achieve our objectives.

Similarly, we will analyze the proposals received for the blocking of private lands. If the broad authority of the Taylor Grazing Act proves inadequate to permit such transactions or conditions essential to their acceptance, we shall likewise seek further legislative authority.

The Department's approach to extended research and development on oil shale includes two essential elements, both aimed at increased knowledge on the nature, extent and technology of the resource and its efficient recovery.

The first of these, identified as Point Four in the announced program, is aimed at the ultimate objective of an in situ retorting process. Interest in such a technique stems from both efficiency of extraction and concern for the landscape and other conservation values. This effort will require close collaboration with the Atomic Energy Commission and, ideally, substantial in-put of private research capability. It also involves extensive preliminary work in core drilling, laboratory analysis and selection of test sites broadly representative of the total oil shale area. As presently conceived, the full development of this research program and its evaluation will cover the better part of a decade and an investment on this Department's part of about $15 million.

On a far more general front, research and investigations must be conducted on other aspects of shale oil recovery as outlined in our Point Five. These will include alternate mining methods research, deeper insights into the basic composition and utilization of shale and shale oil, associate minerals, and related economic and environmental studies. A research program outline and prospectus has been developed for a ten-year effort involving a total budgetary requirement of $86 million, exclusive of the in situ investigations and experiments. We offer this prospectus for the record, with the caveat that it has not been reviewed by the Bureau of the Budget.

This, in general, is the direction we propose to take on this very important resource issue. Much thought and deliberation has gone into the subject over the past four or five years. I think, therefore, that I should summarize for you some of the philosophical or policy considerations that have gone into the development of the proposed program.

Here we have a resource which has lain dormant for nearly half a century since its value was first recognized. The question has been asked in many quarters, "Well why should we bother with it now? Why not let it lie until it is required to meet a real shortage in our energy requirements? Wait until it can demand a premium price!"

In our judgment there are at least two very good answers to this challenge.

In the first place, let us concede that we are in no immediate danger of a national petroleum shortage. Our known reserves, according to present technology, are adequate to carry us into the next century at or about present costs. However, as a recent interdepartmental energy study reports, oil and gas now supply 73 per cent of our total energy requirements, and we have the potential for developing additional reserves through advanced discovery and recovery technology. Conventional sources of these fuels represent the smallest known and potential reserves, world-wide, of all the fuel resources. Thus, unless we are to be forced by possible shortages within half a century into radical dislocation of our heating, power generation and transportation systems, we must begin now to plan for substitute sources.

We have the lead time to plan the development of shale oil on a systematic, economical and sound conservation basis. Past history tells us that the difficulties are formidable. Prudence therefore dictates that we utilize the time available to us now to phase shale oil into our long-range energy forecast. The potential in good quality deposits in Colorado, Utah and Wyoming is on the order of 600 billion barrels of shale oil, or about twice the world's proved petroleum reserves. Deferral of development measures now could easily result in the need for a "crash" effort later with attendant increased costs and sacrifice of adequate conservation planning.

The second, and equally important, reason for moving ahead at this time is that we want the time and experience to fix the policy guidelines that will govern the long-range development of this great energy resource. In this regard, I have established the following policy objectives which we hope will be an inherent part of our ultimate oil shale leasing practices:

1. To encourage competition in the development and use of oil shale and related resources;

2. To prevent speculation and windfall profits;

3. To promote operation and production practices that are consistent with sound conservation management of over-all regional resources;

4. To encourage fullest use of all known mineral resources; and

5. To provide reasonable revenues to the Federal and State Governments.

Mr. Chairman, we do not underestimate the magnitude of the task that lies ahead. Past experience tells us that the hurdles are numerous and formidable. We know, for example, that there are economic and policy issues far removed from our area of responsibility that could have a direct bearing on development trends. One of these, the question of tax treatment, can be readily identified as a serious factor in determining oil shale's competitive standing in the energy community.

Another question to be faced is the perennial one in the West: water requirements and supplies. Research to date demonstrates that the production of crude shale oil itself--the processes of mining, crushing and retorting--requires relatively little water. Refining of shale oil is comparable to petroleum refining in requiring large amounts of water for cooling and steam generation. Municipal requirements for the communities needed to support a large industry would also be comparable to other communities of the same size. Our most recent estimates, developed in 1965, indicate that a 50,000 barrel a day shale oil operation would require 950 acre feet of water per year for all industrial processes through refining. At a million barrels a day, the annual water requirement rises to 20,000 acre feet. Community requirements would be additional.

We are equally aware that the objectives and procedures recently announced do not carry us very far into the development process. But we think we have taken steps in the right direction. We may be unsure of the ultimate rules for routine and unrestricted leasing, but we have started machinery in motion to gather the knowledge and experience for that long-range goal. This, it seems to me, is the important development at this stage of our knowledge.

I have indicated some of the areas where further legislative policy may prove necessary or useful. Based on the attention this committee has devoted to the subject, especially in recent years, we have great confidence that such legislative proposals will receive understanding and informed consideration. In this regard, I would like to emphasize again the ultimate power of Congress to deal with matters affecting the disposal of public land resources. As administrative custodians and technical experts, it is our duty to manage the lands and learn all we can about their values. But we can dispose of those values only as the representatives of the whole people dictate or authorize.

February, 1967

OIL SHALE RESOURCE DEVELOPMENT PROGRAM

PURPOSE

The Nation's oil-shale resources are of tremendous importance to this country's future because of their vast size, because technology has demonstrated that useful forms of energy--oil and gas--can be produced from them, because they may also contain appreciable quantities of aluminum and sodium minerals, and because the costs of exploitation may soon become economically competitive.

Since the major portion of the known richest domestic oil-shale resources are on public lands, the Department of the Interior, as their custodian, has a unique opportunity to insure their wise and effective use in a manner most beneficial to the public interest and the Nation's long term economic growth and security. In particular, the wise use of the vast deposits of the Rocky Mountain Region, as the world's largest single known concentration of hydrocarbons, requires perceptive policy and administrative decisions of major import. To be most effective, such decisions must be made with full and complete knowledge of the economic, social, and technologic factors that determine and influence when and how products from this source become significantly competitive with those from other sources. Liquid or gaseous products from oil shale will enter the market gradually, competing in certain geographic areas with marginal products from other sources. But eventually the products from oil shale will dominate some markets--particularly the oil market.

While extensive information on oil shale and conventional oil-shale technology already is available, very little is known about the mineral content of the oil-shale reserves, or about the possibilities for production of both shale oil and minerals from them. There is a pressing need for more and better knowledge on alternative means of retorting oil shale, on the extent of mineral occurrence in oil shale, and on possible methods combining shale-oil production and mineral recovery.

In addition to extensive studies by the Bureau of Mines and the Geological Survey, industry has invested heavily in oil-shale research and is clamoring for policy decisions on leasing of public lands which will encourage competitive and diverse exploitation by private enterprises.

The following program of research is aimed at furnishing such information. To assure timely and effective implementation, it is proposed that the program be carried out as a joint venture between Federal interests; including the Bureau of Mines, the Geological Survey, the Bureau of Land Management, and other agencies of the Department of the Interior, the Division of Peaceful Nuclear Explosives of the Atomic Energy Commission; appropriate universities under contract, and private firms, including those enterprises that wish to develop an oil-shale and mineral industry.

A 10-year program is proposed herein, at a total cost of $101 million.

At the earliest practicable date, after decisions are made to determine the basis upon which the public oil-shale interests should be exploited, appropriate Federal research activities should make an orderly withdrawal from this field in favor of private enterprise, and resume a baseline research- and resource-development program.

Director, Bureau of Mines

Director, Geological Survey

Director, Bureau of Land Management

CONTENTS

	Page
Purpose	1
Summary	3
Finances	6
Ancillary Support	7
Oil Shale Mining Methods Research	8
In Situ Retorting	13
Oil Shale Composition, Surface Retorting, and Shale Oil Utilization	18
Minerals Associated with Oil Shale	21
Resources Appraisal Studies (Oil Shale and Minerals)	26
Resources Development Planning	29
Impact of an Oil Shale Industry on the Environment	35
Oil Shale Economics Studies	38
Oil Shale Research Facility	41
Alternatives	42

SUMMARY

The program is designed to provide, over the next 10 years, information that will lead to the development of the latent oil-shale resource as a means of increasing the domestic energy and minerals supply, to contribute to the economic growth and well-being of the Nation.

The Green River oil-shale deposits of Colorado, Utah, and Wyoming are to a major extent a publicly owned resource of great magnitude. The equivalent of several hundred years supply of petroleum at present consumption rates exists in these beds on lands owned by the people of the United States. America's economic growth and security in this age is in large part determined by our ability to meet the petroleum needs of our industrial and military machines. An adequate supply of gasoline, jet and diesel fuel, and other liquid and gaseous fuel products can be made available within our borders by development of these resources.

National economic growth is gained by using our natural wealth wisely, so there is good reason to seek the development of effective processes for producing oil and minerals from shale. Inasmuch as the major portion of the richest oil-shale reserve is on public land, our Government has deep public responsibilities to enlarge the knowledge about the resource and, in cooperation with appropriate private interests, to stimulate development through research and experimentation in the mining and processing of oil shale.

There is much evidence of strong interest in oil shale by private industry, and there is widespread belief that technologic advance will bring production costs within competitive range of petroleum within the next 10 years. Six companies have joined with the Colorado School of Mines Research Foundation to conduct research at the Bureau of Mines facility at Anvil Points, Colorado. These and other companies are also undertaking other technologic research; also, the Federal Government is continuing research on oil-shale technology.

Within the United States oil shales occur in at least 29 states. Based on potential oil yield, the best oil shale occurs in the Green River formation in Colorado, Utah, and Wyoming, where in the thickest portions a continuous 2,000 foot section will yield an average of 25 gallons of shale oil per ton of shale. The other domestic oil shales may be considered to be of secondary importance, as they commonly yield less than 15 gallons of oil a ton and occur in thicknesses less than 25 feet. Even though these shales may not be of immediate interest as potential oil sources, there are possibilities of their development as gas sources.

Many of the western oil-shale lands also contain oil and natural gas, minerals, and ground water. Water--essential for shale oil refining, for the communities that would support the oil-shale industry, and for many other existing or potential enterprises--is not in abundant supply, and must be used wisely. The land surface itself--through agriculture, grazing, wildlife, and recreation--is also of considerable value. Plans for mining and processing oil shale must aim not only at high recovery of shale oil, but must take into account other resources and the atmosphere as well and must work to preserve or restore their value.

Despite the fact that much of the knowledge of recovering shale oil is old, the technology is still in its infancy, and many promising new approaches remain to be explored. The in situ process, for example, under which oil would be converted and thermally driven from fractured oil shale underground without mining and without much, if any, effect on the land surface, is an especially promising process for recovering oil from the thicker and deeper parts of the Piceance Creek Basin of Colorado. The vast extent and physical characteristics of the oil shale offer an excellent opportunity for innovations and radically advanced mining systems that would result in low-cost extraction with maximum conservation of the resource and preservation of land and water quality.

Under the proposed program, primary emphasis is placed upon the development of new or improved technology where the promise of improving the economic feasibility of an industry based upon the exploitation of oil shale seems greatest. In particular, a variety of in situ retorting procedures will be developed. Because of the variety of physical conditions under which the resources exist, alternative low-cost extraction processes must be devised. The program will seek to advance technology in this regard. Concurrently, means will be sought to improve upon known techniques and to develop new methods of winning shale oil from oil shale and of studying the products obtainable from shale oil.

While a broad understanding has been gained of the nature and extent of the most significant occurrences, information necessary to objectively appraise specific sites is lacking. Such knowledge is necessary to determine which extraction procedures are practicable and applicable and which local factors might encourage or inhibit commercial development. The program will seek to develop such information, initially to define the sites likely to attract earliest attention, and then to define the conditions under which such sites can be exploited to satisfy both public and private interests.

Major environmental problems are common to the development and exploitation of oil shale, and these must be understood and solved as they relate to all other technologic and economic inquiries concerning oil-shale resources. The proposed program places strong emphasis on determining the impact of an oil-shale industry on its environment.

The research program also is aimed at determining the nature and quantity, and the feasibility and economics of recovery of minerals that occur within deposits of the Green River oil shale.

In addition to the technical research program, it is vital that multiple-resource planning be accelerated so that when oil shale development takes place, adverse effects on other resources, including other minerals such as oil and gas, are minimized. Advance planning will permit other resources to be accommodated to the maximum extent possible. Pollution and aesthetical damage can be minimized and good planning for urban development and roads can be achieved. Techniques of land and resource planning and economic analysis will be used. Close cooperation with other Federal, State, and local agencies is essential. An integrated and interrelated plan for development of the Federal lands would be prepared.

Finally, the program proposes strengthening the Department's capability to provide continuing and timely competence in appraising the complex economic interrelationships among oil shale and other energy sources, both on a regional and national basis and among mineral resources.

The program plan assumes the direct participation and support of many Federal agencies both within and outside of Interior. Similarly, State, institutional, and private interest participation is anticipated in all elements of the program.

FINANCES, OIL-SHALE PROGRAM[1]

Fiscal Year

(Thousands of Dollars)

	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	Total
Oil Shale Mining Methods Research	1,248	2,194	2,304	4,234	5,279	3,809	3,744	3,544	3,044	2,354	31,754
Oil Shale In Situ Retorting[2]	1,036	2,327	1,895	2,098	2,365	1,448	1,371	1,281	739	491	15,051
Oil Shale Composition, Surface Retorting, and Shale-Oil Utilization	759	1,305	1,557	1,509	1,263	1,239	1,241	1,303	1,368	1,436	12,980
Minerals Associated with Oil Shale	300	310	370	490	500	1,060	870	890	600	510	5,900
Resource Appraisal Studies (Oil Shale and Minerals)	2,000	2,500	2,500	3,000	3,000	3,000	2,500	2,500	1,500	1,500	24,000
Resources-Development Planning	300	375	474	500	500	500	500	400	400	400	4,350
Impact of an Oil-Shale Industry on the Environment	200	250	300	525	550	450	450	350	275	150	3,500
Oil Shale Economic Studies	125	125	125	125	125	125	125	125	125	125	1,250
Oil Shale Research Facility	350	2,150	--	--	--	--	--	--	--	--	2,500
Annual Totals	6,318	11,536	9,526	12,481	13,582	11,631	10,801	10,393	8,051	6,966	101,285

---

[1] Estimated total costs, including both Government and industry funding.

[2] FY 1968 includes simulated nuclear experiment. FY 1969 through 1973 includes Bronco, nuclear-explosive, in-situ retorting experiment, as well as other in-situ retorting research, exclusive of Atomic Energy Commission nuclear-explosive and health and safety costs.

ANCILLARY SUPPORT

1. Industry will be invited to participate in joint ventures and to cooperate in the program with work being undertaken under the general direction of joint Government-industry committees which can be formed in cooperation with industry and scientific groups, such as the American Petroleum Institute, university research foundations and others.

2. Provisions will be made for cooperative studies between Government and individual companies or consortiums of companies, including those not now connected with the petroleum industry. In fact, with respect to in situ retorting research, a consortium of some 24-plus companies, with CER-Geonuclear Corporation, Las Vegas, Nevada, as interface, now is negotiating with the United States Government, represented by the Department of the Interior and the Atomic Energy Commission, for joint financing and conduct of a nuclear-explosive, in situ retorting experiment on Federal oil-shale lands.

3. The Federal Government will actively support research directly or through contracts with private organizations, including industry, universities, and foundations.

4. The costs indicated herein are estimated total costs, with the exception of AEC costs of providing and firing nuclear explosives, and conducting the necessary health and safety programs required for nuclear detonations. Any contributions from industry or elsewhere will reduce the costs correspondingly.

5. Multiple-resource planning will involve close cooperation with State and local as well as Federal agencies.

OIL SHALE MINING METHODS RESEARCH

Objective

The mining-research program is intended to develop a mining system technology for the economic extraction of oil shale that is compatible with the requirements for resource conservation and land preservation. The optimum mining system will be correlated to the determinable physical properties and geological conditions of the oil-shale deposits so that the design system will be as universally applicable as possible for oil-shale mining. The system will incorporate the most advanced technology available through research and development.

Program

A ten year program estimated to cost $31,754,000 is proposed that will provide for concurrent research in the major subsystems of rock fragmentation, ground control, materials handling, and environmental control and development of a model mine system design to mine oil shale. At an early stage the investigation will include developing the design and specifications for prototype equipment and testing prototypes. A full-scale demonstration of the design mine system and equipment should follow the 10-year program.

A key element in a conceptual system now under consideration is the use of spent shale as backfill for ground support. A mining system developed around this concept, whereby most of the material mined is returned to the voids from which it was obtained, will vastly reduce surface disposal, and will in addition stabilize the ground during mining, prevent later surface subsidence, permit almost 100-percent extraction of the rock layers being mined, and leave the unmined shale in good condition for later recovery of other minerals if desired. Such a system will require the development of advanced subsystems, particularly for rock breaking and materials handling. It probably will require continuous-mining machines of a type and size that do not now exist, and transportation devices and systems of radically different design. From the standpoint of economics, the system described conceptually offers greater potential than any of the existing conventional mining systems. The physical properties, thickness, and structure of the shale are favorable to the introduction of large, high-capacity machines to eliminate the inefficient drilling and blasting cycle inherent in most existing underground-mining methods and to permit automation in such systems to a high degree. This is a mining method that can yield thousands of tons per man shift rather than the 150 tons per man shift now obtained in the most efficient underground mining methods. At the same time it will accomplish the major conservation objectives.

The program will be conducted as two related phases. Much of the work in phases A and B will be carried on concurrently with constant feedback so individual components can be refined as data are developed.

A. Establish controlling parameters and evaluate their effects.

(1) Resources evaluation and site selection and delineation.

(2) Subsystems research directed to oil-shale mining problems.

(3) Initial mine-system model design (evaluate research data for design purposes).

B. Develop a mining system for oil shale.

(1) Derive, test, and evaluate design components of the system.

(2) Prepare specifications, and contract for and test prototype equipment and techniques.

(3) Complete design of model mining system.

Following is a description of the work contemplated in each phase.

Work Plan

Phase A -- Establish controlling parameters and evaluate their effects.

(1) Available data on oil-shale deposits will be evaluated to determine the resource and engineering data applicable for mine-system design purposes. It is anticipated that currently available data will have to be supplemented by additional drilling and sampling directed to a specific purpose. This work will be correlated with drilling and sampling proposed under other projects of this program. On the basis of the evaluation of these data, a site (or sites) will be selected.

(2) Basic subsystems and engineering research will include work on all of the subsystem elements of a complete mining system, including rock fragmentation, ground control, materials handling, and environmental control. Systems analysis for each specific subsystem will be made.

(3) Analysis of the total mining systems will incorporate the findings of the individual subsystems elements. This work will be expanded and directed to the investigation of oil-shale mining systems. An initial mine-system model design will be made for preliminary

testing of proposed systems on the basis of available data and eventual refinement to an acceptable model.

All parts of Phase A will be carried on simultaneously and continued at varying levels for the life of the project. The basic part of the work should be completed in two years.

Phase B -- Develop a mining system for oil shale.

Phase B -- part B (1) can start and be carried on concurrently with the work on Phase A. Parts B (2) and B (3) depend on basic input from Phase A and part B (1) and will start upon completion of that work. Phase B work will continue at varying levels for the life of the project, but the basic part should be completed in four years.

(1) On the basis of available information and additional data derived from research directed to the purpose, the opportunities and limitations of each subsystem of oil-shale mining methods, techniques, and equipment process will be determined, tested, and evaluated as a valid component of a mining system.

(2) Based on Phase B (1), specifications will be prepared for applicable methods, techniques, and equipment; R and D contracts will be let as appropriate, and tests will be conducted on a prototype scale.

(3) The model mine system will be completed, tested, and specifications will be prepared for full-scale demonstration.

(4) Complete, test, and prepare specifications for full-scale demonstration of the model mine system.

Phase C -- the final stage of the project will be a full-scale demonstration of the designed mining system at a selected representative site. The demonstration will serve to both test the system and provide an opportunity to debug and refine the system. The major part of the work is planned to start during the fifth year of the ten-year project and to be completed by the tenth year.

IN SITU RETORTING

Objectives

1. Develop techniques for in situ retorting of oil shale that will be applicable to various deposits of Green River oil shale in Colorado, Utah and Wyoming.

2. Correlate these techniques with properties of the deposits to determine the best technique to employ for conditions at any specific location in the area.

Program

A 10-year program is proposed, with provision for later further extension, that will demonstrate the potential of methods for fracturing and retorting Green River oil shale and that will develop additional techniques to supplement or improve now envisioned methods. The cost of the program for the 10-year period is estimated at $15.0 million. The proposed research will complement other research on above-ground methods of converting kerogen to shale oil and will utilize data derived from proposed basic research.

Work Plan

A. Determine the nature of oil shales of the Green River formation, by laboratory and field measurements and analyses, to establish the conditions in the deposit and to relate results of an in situ experiment at a given location to the entire deposit. The study will include:

(1) Core sampling of oil shales believed to have different characteristics in four intervals in Colorado deposits, in three different beds and one unexplored deposit in Wyoming, and in one interval in Utah. Core sampling will be done largely during the first two years of the program. It will involve drilling boreholes and recovering about 6-inch-diameter cores of oil-shale intervals and adjacent intervals that may affect the in situ process. The following holes will be required in the three States:

Colorado -- Core mahogany zone, poor core-recovery zone, nacholite zone, and basal Parachute Creek formation. This will require at least three holes, each of which will be 3,000 feet deep, with some 2,000 feet of core.

Utah -- Core mahogany zone. This will require a 1,000-foot hole and 500 feet of core.

Wyoming -- Drill two coreholes to sample the Laney member and two coreholes to sample the Wilkins Peak and Tipton members. These holes will total 7,000 feet, including some 3,000 feet of core.

This work will be fully correlated with coring, sampling, and resource-appraisal work proposed under other projects of this program.

(2) Conduct laboratory analyses and research on representative cores to determine richness, composition (organic content), lithology, and physical (mechanical) rock properties. Use holes from which these cores are obtained to conduct selected rock-property determinations on oil shales in place where they are affected by depth of burial and other formation conditions.

(3) Based on the determined properties of rock specimens and rocks in place, use statistical and other techniques to design experiments to select rock parameters and conditions that appear the most promising for creating desired permeability and in situ combustion conditions at different locations in the Green River formation. This work will start as soon as data are available and will continue for the remainder of the program.

B. Conduct a field experiment, or experiments, to develop an in situ technique utilizing methods of fracturing and underground combustion considered to be the most promising.

The steps involved in such an experiment are to select a suitable site, conduct controlled fracturing tests, set up necessary surface facilities for conducting and controlling an in situ combustion experiment, conduct the experiment, and evaluate the results obtained. Site selection and establishing the characteristics of the deposit will be largely handled through phase "A" of this program so that only rather minor preparatory work will be done during the first year under this phase of the program. Development of an efficient recovery experiment may require 4 to 8 years, with much of the work being done during the fourth to seventh years of the program.

C. Perform laboratory and field research on novel methods of fracturing oil shale in place such as electrical fracturing and the use of chemical high explosives in preinduced fractures to develop techniques applicable to shallow or thin oil-shale beds.

D. Determine the feasibility of using nuclear explosives for fracturing large quantities of shale preparatory to in situ retorting for use in deep, thick sections of the deposit amenable to the required scale of operation. This investigation consists of four parts:

(i) Based on laboratory and bench-scale results, design and conduct simulated nuclear experiments to approximate the known and expected conditions that will exist in a nuclear chimney following fracturing by a nuclear explosive. The primary purpose of the experiments will be to develop retorting and recovery methods applicable to large quantities of ungraded shale. The advantages of such experiments rather than proceeding directly to a nuclear blast, are that extensive analyses of the shale are possible and instrumentation for following the course of the retorting can be installed readily. Designing, conducting, and evaluating this part of the investigation will require about two years.

(2) Design and conduct an experiment using a single nuclear explosive. Because the criteria for selecting a site for a nuclear fracturing experiment are different from those for selecting a site for other types of in situ experiments, considerable additional exploratory work over that designated in phase "A" will be required. A site for a nuclear experiment must be located in an area where the thickness of the shale is great enough to make complete use of the fracturing potential of the device and where the combined thickness of shale and overburden is great enough to insure complete containment. For experimental purposes, this site should also be in a sparsely populated area away from other developments including mine workings and tall above-ground structures. The location of aquifers, if any, must be known. Following the nuclear fracturing, an extensive program to determine the characteristics of the broken shale will be completed before retorting and recovery are started. Preparations for nuclear experiment will be started in the first year of the program. Following selection of a suitable site, which is currently underway, one to two years will be

required for preparing the site and detonating the nuclear device, and two or three years to evaluating the fracturing results, conducting the retorting and recovery experiment, and evaluating the results.

(3) Develop recovery techniques suitable for application to masses of rubble created by multiple nuclear explosions. Site selection for this experiment will probably have been accomplished at the same time that the site for the single explosion is selected. The placement of the nuclear devices, the connecting of the actual detonations, and the post-shot exploratory work on the extent of fracturing accomplished will be similar but on a larger scale than when a single device is used.

This investigation of multiple nuclear explosions will not be started until sufficient information has been obtained from the single shot experiment to indicate that the multiple shot concept has merit. This will be in the sixth to seventh year of the program. Then, as with the single device experiment, one to two years will be required for the nuclear fracturing phase of the experiment and two to three years for the combustion and recovery phase of the experiment. Therefore, this part of the program will be started and completed during the 10-year program. If successful, experimentation may extend beyond a total of 10 years.

(4) Develop techniques suitable for recovering oil from the fractured zone adjacent to or between nuclear chimneys.

OIL SHALE COMPOSITION, MINING, RETORTING, AND SHALE OIL UTILIZATION

Objectives

1. Develop improved techniques for obtaining shale oil from oil shale.
2. Upgrade the quality of shale oil.
3. Investigate products obtainable from shale oil, particularly chemical by-products.
4. Determine characteristics of oil shale and shale oil and how these characteristics affect the technology of shale-oil production.
5. Investigate problems of spent-shale disposal.

Program

A 10-year program is proposed to perform both basic and applied engineering research on: (1) The physical and chemical properties of oil shale and kerogen (the solid organic material in oil shale from which shale oil is derived by heat treatment) as related to occurrence in the deposit and how the properties vary with geologic conditions; (2) composition of shale oil, shale-oil components, and shale-oil fractions with particular reference to heavy hydrocarbon fractions; (3) application of basic data on the properties of oil shale to improve processing methods; (4) fundamentals of catalytic, thermal, and chemical treatment of shale oil; (5) effects of retorting temperature variables; (6) effect of physical properties of oil shale on efficiency of crushing; (7) methods for retorting oil-shale fines; (8) techniques for utilizing spent (retorted) shale; and (9) spent-shale disposal problems.

The total cost of this research over the 10-year period is estimated at $13.0 million.

Work Plan

The following work plan assumes that the various projects will be conducted concurrently, all beginning in the first year that research is authorized, with the relative effort dependent upon staffing and obtaining required equipment.

A. Study the nature of oil shale with emphasis on changes with depth or location of shale and relationship between nature of shale and oil produced. Investigate chemistry involved in conversion of organic material to oil to provide data for improving present conversion processes or devising new ones.

B. Study composition of various shale oils with emphasis on the heavy hydrocarbon fractions about which little information is available. Correlate data with engineering research on the production of shale oil and end products. Develop techniques for separating materials from shale oil for other than fuel uses, emphasizing engineering applications. Apply data on chemistry of shale-oil components and process variables to improve processes. Develop analytical techniques useful in research and process control.

C. Study physical properties and physical chemistry of oil shale to obtain basic engineering data on which improved processes may be developed.

D. Study fundamentals of catalytic, thermal, and chemical treatment of shale oil to devise techniques for improving refinability and properties. Develop techniques for producing a suitable source material for the production of valuable products other than fuel.

E. Study effects of pyrolysis variables (temperature, rate of heating, etc.) on crude shale-oil properties and composition to devise techniques whereby crude shale oil of improved refinability may be produced.

F. Obtain data on physical properties of oil shale and apply such data to devising more efficient crushing techniques.

G. Conduct laboratory and pilot-plant studies to develop an efficient retorting process capable of handling fines as well as larger particles.

H. Conduct laboratory and field studies on spent-shale disposal problems.

MINERALS ASSOCIATED WITH
OIL SHALE

Objectives

1. Identify and determine the amounts and characteristics of valuable minerals in Green River formation oil shales on Federal lands in Picenace Creek Basin, Colorado.

2. Develop new processes and determine their technical and economic practicabilities for recovering the alumina and soda (and other minerals that may be discovered during other segments of the program) contents of the specified oil shales.

3. Provide information for determining the geology and reserves of the minerals.

4. Determine the economics of preparing marketable mineral products for oil shale.

Program

A 10-year program is proposed to perform both basic and applied research on:

1. The identity, amounts and properties of valuable minerals in presently available representative samples of oil shales in Piceance Creek Basin through the procurement and analysis of representative core samples of the mineral-containing oil-shale beds that have not been adequately sampled.

2. The metallurgy of extracting and converting the oil-shale minerals to commercial products.

3. The geology and resourced of the minerals.

4. The economics of recovering the mineral values in oil shale in conjunction with processing the oil shale for its shale-oil value.

The total cost of the research on the identity, amounts, and properties of the valuable minerals over the 10-year period is estimated at $5.9 million.

Work Plan

A. Identify, estimate the amount, and determine the chemical and physical properties of the minerals occurring in the oil-shale deposits. For Picenace Creek Basin, Colorado, this involves the rock matrix minerals, but applies principally to incompletely identified sodium and aluminum minerals such as nahcolite and dawsonite that are large and important potential sources of industrial chemicals. This basic information must first be obtained to initiate other studies for appraising deposits and means of recovering the minerals. Work can be started immediately after authorization on samples now available. It can then be expanded to other deposits by procurement of samples held by the Geological Survey and private companies and by new core drilling.

B. Study the metallurgy of the minerals, devise processes for extracting the valuable ones in conjunction with the production of shale oil, and develop methods for converting the extracted minerals to basic industrial chemicals.

1. Amenability of unretorted oil-shale minerals to chemical extraction. The possibility of recovering the valuable minerals before retorting will be investigated in order to cover all possible facets. Minor effort will be expended here.

2. Determine amenability of retorted oil-shale minerals to chemical extraction. All plausible techniques for extracting alumina and soda from retorted shale will be investigated. Studies will be based on optimum retorting practice for oil extraction to take advantage of chemical and physical properties imparted during retorting. Testing will include oil shale both hot from retorting and cold after storage. Effect of moisture from open storage will be determined.

3. Determine effects of changing oil-shale retorting practice on extracting alumina and soda from oil shale. Optimum retorting practice for oil recovery may not yield the most suitable material for extracting other valuable minerals. Assuming alumina and soda are coproducts with oil, optimum processing for the total system of oil retorting and mineral extraction will be determined. Additional work under this element will include investigation of processing techniques in which, simultaneously, oil will be removed and minerals rendered readily extractable by subsequent chemical action.

4. Evaluate laboratory data and determine most feasible processes. Results of investigations for research phases 1, 2, and 3 will suggest the most promising processing routes. Additional investigations will be required to determine the optimum sequence of operations for processes based on best methods of extracting alumina and soda from oil shale. Optimum process for recovering final alumina and soda products will be based on most economic sequence of operations, not the best means of extraction alone.

5. Develop pilot-plant design data by large-scale laboratory study of the more likely processes. Design and sizing of process equipment and flowsheets will require substantial investigation to establish material and energy balances, materials of construction, and probable effect of recycle streams in large-scale operations. Effective operation under this element will give information to narrow choices of possible processes and give data required for a well engineered pilot plant.

6. Evaluate large-scale laboratory data to choose optimum process for pilot-plant study. This research phase will consist primarily of estimating capital and operating costs for the better processes to select the least expensive for development in pilot plant. Also included will be technical evaluation to expose possible areas of operating difficulty in the pilot plant and to point out areas where additional investigations might provide techniques to lower costs.

7. Design and construct pilot plant. Design of pilot plant will be based on process information provided by research phases 5 and 6.

8. Conduct pilot-plant investigation to develop optimum process for treating appropriate types of oil shale. Pilot plant study

will develop the single most promising process and provide a base for possible commercial demonstration efforts. In addition, suitability of process to varying types of oil shale from other horizons as disclosed by concurrent phases of oil shale program will be demonstrated.

9. Final evaluation of pilot plant data. This work element will complete the process-development package by providing accurate estimates of capital and operating costs for a commercial plant and by resolving technical problems uncovered in the pilot plant.

C. In cooperation with geologic appraisals of the deposits under resource appraisal, study the extent, character, and resources of the minerals.

D. Evaluate the economics of commercially extracting the minerals, as well as shale oil, from the deposits and their conversion to industrial chemicals.

Concurrent with part C above, a minor research effort will be conducted as necessary to provide additional information relating to varieties of oil shales disclosed as geologic and mining investigations progress.

RESOURCES APPRAISAL STUDIES
(OIL SHALE AND MINERALS)

Objective

The objective of this program is to provide geologic and engineering information and analyses of data on the oil-shale resources in relationship to their location, extent, quality, physical and chemical properties, and inclusive up-to-date technology. These data will be necessary to both industry and Government as a basis for decisions in the planning for and commercial production of shale oil as a supplement to petroleum and natural-gas supplies. The geologic data become input to additional economic and technologic appraisal and feasibility studies of the mining, processing, and marketing of these resources; such as the location of industrial operations; the size and accompanying technologic-economic factors in mining, processing, and production; present and future markets and transportation; and the effects on other resources.

A 10-year program is proposed on oil-shale resource appraisal studies requiring $24 million.

Program

The principal initial studies to appraise oil-shale deposits will be concentrated on the Nation's largest and most nearly commercial deposits in Colorado. Previous studies have led to rough estimates of extent, thickness, and approximate quality of the oil shales in the Piceance Basin. More precise knowledge of the deposits, essential to general planning for utilization, will be sought, as well as determination of the extent and quality of the deposits in Utah and Wyoming, which are less well known.

Work Plan

The program of appraisal will consist of integrated topographic and geologic quadrangle mapping as a basis for detailed planning and engineering appraisal; drilling for geologic information necessary to better define oil-shale thickness and grade trends in the basins as a whole; the relations of oil shale to associated saline deposits such as nahcolite, dawsonite, and salt; and to oil and gas accumulations, gilsonite, and tar sands; drilling for engineering uses such as the specific oil-shale content of selected areas; economic analyses and treatment tests; and related topical investigations. During the 10-year period the principal oil-shale deposits of Colorado, Utah, and Wyoming will be studied in sufficient detail to permit the evaluation of their production potential. Quadrangle mapping will upgrade existing geologic maps, which are on planimetric or other low quality base maps, as well as provide detailed coverage of the several potentially valuable mineral deposits that are thus far unmapped except in reconnaissance. Geologic core drilling, supplemented by drilling done for reserve determination or economic appraisal, will provide information necessary for understanding and appraisal of the basins as geologic units. This coring and sampling will be correlated with other coring and sampling proposed under other projects of this program. Geochemical investigations will be made of other valuable resources, such as sodium minerals, and geophysical investigations will be made to determine physical properties of both the economic deposits and the adjacent wallrocks; ground water and brines within the oil-shale bearing rocks will be appraised to determine their relationship and possible uses and effects on mineral utilization.

Utilization of oil-shale depends on many factors such as grade properties, thickness, and depth of the formation. The surrounding rock formations, the locality and mine-sites acess, haulage, and suitable plant sites are all of prime importance.

Coring and sampling of the Piceance Basin is proposed as the major initial part of a 10-year national coring and sampling project. The first three years of the 10-year technical studies will be in the Piceance Basin on Government lands. Private ownership of the western oil-shale lands has been concentrated on those areas where the shales crop out. The very much larger deposits deep underground, away from the outcrop areas, have remained in the possession of the Federal Government and less is known about them. Some broad estimates are that about 80 percent of the Green River oil shale is in public domain. Delineation of these deep lying deposits by means of coring and logging is necessary to assess their extent and quality. Selection of specific areas for mining projects requires development drilling at closer intervals to verify tonnage and grade estimates that are now based only on widespaced exploration drilling.

In the first year, key sites will be core drilled. Analyses of cores and samples from these coreholes will be used in directing additional coring and sampling work that will be needed to complete the delineation and mapping of the deep-lying Piceance Basin deposits. In subsequent years the work will be extended to include the Uinta Basin of Utah and the Green River and other basins of Wyoming and Sand Wash Basin, Colorado.

RESOURCES DEVELOPMENT PLANNING

Objective

The objective of this program part is to provide comprehensive plans for development of the publicly-owned resources in the oil shale areas. Comprehensive planning will provide:

1. Evaluation of best mining or extraction methods for the various oil shale areas in terms of mineral conservation, prevention of pollution and aesthetic damage, safety, and economic operations.

2. An estimated schedule of oil shale development by area.

3. An evaluation of all the resources involved in the region and the opportunities for multiple-use of selected areas.

4. An evaluation of water, electric power and other utility needs and transportation and communication needs.

5. Urban planning for an oil shale industry.

6. Economic analysis of conflicting and complementary resource use, alternatives in leasing, incentives, and allocation of recepts.

7. An overall plan for development of the various oil shale basins and the portions thereof. Tentative identification of basins into various multiple-resource units for various types of mining or extraction, and for solution of possible pollution problems.

A 10-year program costing $4,350,000 is comtemplated.

Program

A. Evaluation of Mining and Extraction Methods

1. Mine Site and Type

Studies will be made of different methods for mining oil shale, including the data from mining research proposed elsewhere. Each

method will be identified and analyzed to set up selection criteria of systems and sites based on such factors as topography, water supply, delivery of shale to plant sites and spent-shale disposal as related to industrial applications.

The methods fall into three main categories:

1. Open-pit mining
2. Underground mining
3. In situ retorting

Factors to be investigated in evaluating different tecnniques include pit- or underground-mine design with respect to physical setting, optimum size of operation, allowable cost of shale delivered to processing plants, and safety.

Data from in situ retorting research proposed elsewhere in this program will be studied with respect to choice of methods for preparing shale beds for retorting, initiating and maintaining a retorting process, and recovering the shale oil produced. The techniques to be considered for preparing the shale beds include use of nuclear energy, chemical high-explosives fracturing, electrical fracturing, and hydraulic fracturing.

2. Mine design and economics

Design of a mining operation will consider tonnage and grade requirements, safety and health aspects, and optimum extraction of the material. The design will incorporate current conventional methods, as well as adaptation of new concepts resulting from the research program on extraction and transportation methods. Estimated costs for each mining method--that is, surface, underground, and in situ--will be considered at various tonnage levels.

3. Safety considerations

Safety is a primary consideration in the planning and design of any mining system, whether it be underground or on the surface. The type and degree of protection that can and must be provided for both men and equipment may well determine the technical and economic feasibility of any large oil-shale development. Most design factors based on the strength and character of the rock, such as the size and shape of underground openings or the depth and slope of surface pits, must be considered in relation to their effects on production workers and expensive equipment. Actual production operations, such as breaking and handling of rock, are more flexible but also must be planned for maximum safety. Environmental health of workmen is another important consideration, particularly in the design of ventilating systems to control dust, temperature and humidity.

B. Multiple Resource Planning

The key to orderly and wise resource development is planning. For example, many people consider the Piceance Creek Basin oil shale area of Colorado as possessing value for oil shale only. This is not the case. Not only oil shale but valuable and potentially valuable oil, gas, aluminum and sodium are also known. Surface values include watershed, significant wildlife and recreation, scenic values, grazing and ranching. Depending on methods of extraction, mineral development could cause air and water pollution and aesthetic damage. Proper planning can minimize these undesirable impacts.

Conflicts of resource use are inevitable and even if mineral development predominates, as seems likely, all the development will not proceed at the same time or place. Multiple-use, with proper planning, can still take place. Other uses can often be accommodated elsewhere.

Mineral development will place increased demands on water and electric power supplies. Urban development planning and road planning will be vital.

All of the previous planning has been on the basis of an industry on private lands near the edge of the Basin with urban development taking place along the Colorado River. Planning of development of the Federally-owned center of the Basin is needed.

The first step in proper planning is to bring together the basic information. This step is called resource analysis or inventory which involves gathering information from all available sources on all the various resources involved and placing this information in useful form--often on maps. For example, even on oil shale, the information on the resource is badly fragmented and scattered. Where and what quality are the low grade resources in relation to the richer deposits? What is the land ownership and status? Often this phase alone will reveal certain relationships or inter-relationships which are not readily apparent--yet are vital in proper planning.

The second step would be the analysis of the Invention information and tentative subdivision of the Basin into various resource units.

This might involve leasing units considering such things as types of multiple-mineral deposits, types of mining or extractions, surface values, aesthetic values, pollution control, etc. It is possible that because of pollution or aesthetic or other considerations certain special controls or stipulations would be required in some areas. It is conceivable that units would be established for nuclear and other in situ testing, various types of underground mining, open pit mining, oil-shale-development-only areas, multi-mineral development areas, buffer or pillar areas around oil and gas wells, urban sites, plant sites, critical water areas, etc. The timing and scheduling of development is obviously an important factor. The key to this step is comprehensive planning for the Basin as a whole and relating the individual units to the whole and to each other.

The third phase which can be done concurrently with steps 1 and 2 is economic analysis. The lack of adequate economic analysis has been a continuing criticism of resource planning since the Paley Commission Study. Decision makers need the results of such analysis in order to make informed decisions. Economic studies are needed in such things as: conflicting and complementary resource-use benefit-cost analysis; alternatives in leasing, such as, terms and royalty; need for and possible effects of various types of incentives; allocation of receipts from leasing (in view of potential revenue, what alternatives may be worth considering); economic effect of alternatives in extraction, such

as, recovery and conservation; and benefit-cost analysis of environmental effects of mineral development. No duplication of existing or planned economic stuides by other agencies, universities or others is planned; in fact, the proposed studies complement each other.

This resource offers unique opportunities for close cooperation with private industry and local and State governments in the development of plans.

IMPACT OF AN OIL SHALE INDUSTRY ON ITS ENVIRONMENT

Objectives

1. To obtain solutions to problems arising from waste materials--especially air and stream pollutants--that will be produced in industrial oil-shale operations.

2. To devise and demonstrate economical methods of restoring mined areas and converting spent-shale dumps to attractive and useful grounds.

Program

The cost of a 10-year program, based on these objectives, is estimated at $3,500,000.

The work planned for the initial phase of the program will consist primarily of the following:

(1) Determining the amounts and nature of gaseous emissions from aboveground retorts of various types; (2) ascertaining the relationship of terrain to retort location and evaluating factors that bear on area-toxicity dispersion; (3) investigations of landfill requirements and possible utilization of spent-shale fill for constructive use as industrial sites and restoration of mined-out areas; (4) studies of spent-shale dumps from past operations to determine the siltation of water courses, amount of leaching of contained salts by rainfall over the intervening years since the dumps were originally formed, and the relationship of leaching of retorted shales to naturally weathered shales from talus slopes.

During the second phase samples and data will be obtained from experimental or commercial operations for detailed studies concerning

pollution problems due to burning, fuming, smoke, and dust from fresh spent-shale dumps.

As commercial operations develop, continued and enlarged studies will be conducted on these problems. Among these are development of methods and determining costs of shale-dump stabilization and of reconstitution of retorted shales. Using spent-shale to fill arroyos on eroded lands; leveling and stabilizing spent-shale erosion moraines; and possible application of self-cementing and compacting procedures, using the cement type materials naturally present in spent shale, also will be studied. These procedures, combined with methods that allow natural reconstitution into soil, will be investigated as well as the possible use of soil and vegetation cover, with a view toward ultimately rendering the spent-shale dump areas usable as agricultural and grazing lands.

Ways of preventing the leaching of excessive amounts of soluble minerals from spent shales by water from rain and melting snow will be sought. These dissolved minerals, if allowed to enter streams in uncontrolled quantities, could create problems for downstream communities.

Methods and costs of collecting and utilizing or disposing of dust from large-scale crushing and screening of oil shale will be studied. Shale fines may be screened from retort feeds and discarded. Measures [illegible] be needed to stabilize the shale-fines dump areas.

Liquid waste materials produced by oil-shale and shale-oil processing, such as waste oils, sludges, [illegible] liquors, water contaminated with various oils, chemical and organic substances, and gaseous refinery emissions present serious potential difficulties. Methods must be found to prevent these substances from entering the atmosphere or draining into streams.

OIL SHALE ECONOMIC STUDIES

Objective

The objective of the general economic studies is to provide continuing and timely understanding of the complex economic interrelationships among oil shale and other energy sources, both on a regional and national basis, to serve as an aid in guiding the overall research program, and to aid in establishing Federal, State, and industry policies. The energy industry consists of a complex network of relationships among suppliers, processors, and consumers. Any change in the availability or cost of a source of energy, or the introduction of a new source either regionally, nationally, or or internationally, can have far flung and subtle effects throughout the industry. The objective here is to understand the impact of the development of oil shale in all its ramifications and, conversely, to understand the responses of the other energy sources as they affect oil shale. Such an understanding will permit more perceptive policy responses. Economic studies related to resource planning are included under the Resources Development Planning Program.

Program

A series of special studies, as well as a continuing analytical appraisal, will be undertaken over a 10-year period at a cost of $1,250,000. This series of studies will use as major inputs the analytical models developed in the general program.

One such special study will investigate the developmental impact of various assumed levels of shale-oil costs. This involves integrating with the assumed level of shale-oil availability the price elasticity responses of other energy sources and the developmental regional impacts resulting from alternative levels of market penetration. Corollary to this study will be in-depth examinations of costs from an overall view and the implications of successful research on these costs. This study is distinguished from the process-evaluation studies in that it is of a general purpose nature.

The development of an oil-shale industry in the Rocky Mountain area will clearly have a major effect on the general economy of the region. The implication of this effect as reflected in population shifts, demands for materials, expansions of services and utilities, and the transportation network will be examined. The net effect on other regions will also be included. Such a study will indicate potential problem areas in ample time for steps to be taken for their solution.

The competitive impact on alternative fuel sources will be examined. From such an examination, judgments as to the disruptive effects of various rates of growth in the oil-shale industry itself can be made. Possible dislocations can be pinpointed and their seriousness evaluated.

The petroleum industry is, and the potential oil-shale industry will be subject to Government controls that affect their profitability, rate of investment, and rate of growth. Federal import controls, tax provisions, and public-land leasing directly bear on the operation of the petroleum industry. This industry also operates under prorationing regulations enforced by the various States. These policies also have implications for an oil-shale industry, both directly and indirectly. The studies under this program will be aimed at understanding the effects of

alternative policies in different areas under direct Governmental control. This will permit a better achievement of Governmental objectives with respect to these energy industries.

OIL SHALE RESEARCH FACILITY

Objective

It is anticipated that some of the research proposed herein, especially much of that described under In Situ Retorting; Oil-Shale Composition, Surface Retorting, and Shale-Oil Utilization; and Minerals Associated with Oil Shale, will be conducted at or correlated from existing facilities. Present facilities are not adequate for an appreciably expanded research program. Consequently, the additional facilities proposed herein will be necessary if the entire program or significant parts of it are approved and authorized.

Program

1. Complete present building to three stories by adding three floors to North wing and one floor to South wing. According to plans drawn up some years ago, this would provide space for twelve laboratories, six offices, and a combined library-assembly room. The cost would be about $350,000.

2. Replace present annex with a 4-story L-shaped building to provide about 40,000 square feet for new work and 15,000 square feet for activities now quartered in the annex. The cost of this building would be about $1,650,000. The two construction projects would nearly double the present floor area. It would require about $500,000 to furnish and equip the added construction, totaling $2,500,000.

ALTERNATIVES

As custodians of the Public Domain, the Department of the Interior must maintain a high level of competence and knowledgeability in regard to both the technology of extraction and utilization of oil shale and the factors that influence its value under various economic and emergency conditions.

Present programs permit the Department of the Interior to observe what others are doing, within the limits of proprietary information, and to mount a modest effort to add to the knowledge of the nature of the oil-shale resource and the chemistry of shale-oil products. This is a minimal effort that is inconsistent with the potential significance of the resource; however, it is the only realistic alternative to the program proposed herein.

DEPARTMENT OF THE NAVY
NAVAL PETROLEUM AND OIL SHALE RESERVES
WASHINGTON D C 20360

21 February 1967

Statement of Captain Howard N. Moore, USN, Director,
Naval Petroleum and Oil Shale Reserves, in connection
with development of oil shale.

Mr. Chairman and members of the Committee, I am Captain Howard N. Moore, U. S. Navy, Director of the Naval Petroleum and Oil Shale Reserves. I appreciate this opportunity to appear before the Committee to present the position of the Navy Department in regard to the development of oil shale as a commercial energy source. In particular, I will make reference to the five point program recently announced by Secretary of Interior Udall for economic development of this valuable natural resource.

It is perhaps appropriate first to explain the basis for the Navy's role and interest in oil shale. Between 1916 and 1924 some 145,000 acres of public land were set aside by Executive Order for the exclusive use of the Navy as Oil Shale Reserves. Two of these reserves are located in Garfield County, Colorado and a third is located in Carbon and Uintah Counties, Utah. The total acreage comprising the Naval Oil Shale Reserves is approximately two per cent of the Federally owned oil shale lands in Colorado and Utah.

Congress, by statute, placed these Oil Shale Reserves in the custody of the Navy with the specific mandate to maintain them for future use in the event of a national emergency. These Reserves, like the Naval Petroleum Reserves, may not be produced commercially until the Secretary of the Navy, with the approval of the President, finds that production is needed for national defense and is authorized by a joint resolution of Congress. The statutory basis for the Navy's control of the Oil Shale Reserves is now codified in Title 10, United States Code, Sections 7421-7438.

For some years the Navy has consistently supported and encouraged efforts being made by other branches of the Federal Government and private industry to advance technology to the point that shale oil could become competitive with other types of fuels. It is obvious from the standpoint of national defense that if the Oil Shale Reserves are to make a significant wartime contribution, there must exist at that time a viable oil shale industry. It is unlikely that sufficient time or resources will be available during a full scale emergency for development of such an industry. In addition, the vast amount of liquid fuels which may be made available through a going oil shale industry will greatly decrease, if not eliminate, any wartime requirement to import conventional fuels by sea. This is of great importance today because present trends indicate the United States is becoming a crude deficient nation and may in the future be forced to rely more and more upon imported fuels to meet even peacetime demands. For these reasons, the Navy fully supports Secretary Udall's five point program as a sound basis upon which the first steps may be taken toward the orderly development of oil shale on public lands. I will attempt to specifically relate each of the points included in the program to operations on the Naval Oil Shale Reserves.

POINT I. Action to clear title to the public oil shale lands in Colorado, Wyoming and Utah.

Today, the private right to develop the public oil shale lands can only be acquired under the terms of the Mineral Leasing Act of 1920. Large numbers of unpatented mining claims covering the oil shale lands presently make leasing of these lands rife with potential legal difficulties arising out of disputed ownership.

The Naval Oil Shale Reserves are now relatively free from title disputes. We are working with the Department of the Interior to clear the few disputed titles remaining on Reserve lands and excellent progress has been made to date. The primary interest of the Navy with this part of Secretary Udall's program is that settlement of these disputed claims on public lands will remove an obstacle to the orderly development of an energetic oil shale industry. Not until this industry has been developed will the Naval Oil Shale Reserves become a meaningful asset.

POINT II. Plan to permit blocking of oil shale lands into workable units.

Mr. C. E. Reistle, Chairman of the Board of Humble Oil and Refining Company, in his speech before the 95th Annual Meeting of AIME (American Institute of Mining, Metallurgical and Petroleum Engineers) on March 1, 1966, gave some basic indication of the economic parameters limiting the development of a commercial oil shale industry. He said:

> "There are two major methods that are being studied for getting oil out of the shale: (1) mining and retorting and (2) in situ retorting. Work is going forward on both methods; one or both may ultimately prove to be economically feasible. Using the mining and retorting method, a minimum shale oil plant is believed to be one which will produce at least 50,000 barrels of oil per day. Such an operation involves mining, crushing, and retorting 80,000 tons of shale per day. Capital investment in such a plant, including upgrading facilities, would be in the order of $100,000,000."

Projecting Mr. Reistle's figures leads one to conclude that an economic unit of shale for commercial retorting would have to include reserves of about one billion tons of mineable shale of 15 gallon per ton or better richness; or viewed from a different angle, recoverable oil reserves of at least 365 million barrels.

Our studies to date indicate support for the view that the huge capital investment will, from the standpoint of economics, require that any regulations promulgated take this factor into consideration. Although the Navy is not directly concerned, it does recognize the importance of permitting the blocking up of Federal Oil Shale lands into economically attractive units, and so would endorse it.

POINT III. Plan to consider provisional development leases.

We now support utilization of the Anvil Points Facilities on Naval Oil Shale Reserve No. 1 by the Colorado School of Mines Research Foundation as a means of making these facilities available for experimental retorting. Under an agreement specifically authorized by existing law, shale from the Reserve is now being used by private industry at the Anvil Points Plant. Private industry has already expended some $2.7 million in this undertaking, and a $4.5 million expansion of the basic research program there is currently underway.

This program indicates the feasibility of the approach suggested by Secretary Udall's third point. If the regulations and provisional development leases issued contain the requirements outlined in his announcement, it appears to me that research and development programs will be assured and at the same time the holding of the great bulk of these lands for purely speculative purposes will be prevented.

POINTS IV AND V. AEC Assistance and funds for research.

The cost of mining and handling large volumes of shale by surface retorting processes and the problem of disposing of spent shale on the surface make the development of some efficient type in situ retorting process highly desirable. The use of atomic explosions underground is one approach to this problem. The atomic explosion itself will be expensive, and as yet there is no evidence to indicate that in situ retorting of oil shale is physically practical. In this connection several questions need to be studied:

(1) Can currents to carry oxygen to the combustion chamber be maintained?

(2) Can permeable channels or fractures through which the retorted oil can flow to wells be opened and maintained?

(3) Can the size and location of the combustion zone be satisfactorily controlled?

We would assume that small scale, conventionally fired in situ retorting experiments first would be carried out to assist in finding the answer to these questions. We believe the shale beds on the Naval Reserves are too shallow to be safely or productively utilized for atomic experiments. However, some of the older mine workings on Naval Oil Shale Reserve No. 1 might be utilized for any limited underground retorting experiments which might be required prior to engaging in major atomic undertakings elsewhere.

It is possible that an atomic device will not prove practical for use in the in situ retorting of shale oil, and certainly not in all locations. As previously alluded to, one of the major problems to be solved in in situ retorting is the creation of an extensive fracture system through which fluids can readily pass. Oil shale is a dense, impermeable rock in its native state. Conventional hydraulic fracturing techniques known to the oil industry today may not be applicable because they create a few large fractures, and what will be needed for in situ processing of oil shale is a highly fractured, broken rock zone. The Bureau of Mines is studying explosive fracturing methods whereby a liquid explosive is pumped into the rock, following small fractures or fissures back into the formation, and then detonated. Preliminary results from this process look promising. The Navy has modestly supported this research with funds for several years and has offered to provide a location on Naval Oil Shale Reserve No. 2 in Utah for field tests of this process in an oil shale formation.

In connection with anticipated research, the matter of spent shale disposal is of considerable interest to us. Unless vast piles of spent shale are to spoil the landscape as a result of oil shale mining and surface retorting, a research effort must be undertaken leading toward some practical means for the economic utilization or disposal of spent shale.

In conclusion, I would like to state that my Office stands ready to assist this Committee, the Department of Interior and industry in carrying out this oil shale program in any way consistent with legislation controlling the Naval Oil Shale Reserves.

This is the end of my prepared statement, however, members of my staff and I will attempt to answer any questions you may have on this matter.

Statement by

John S. Kelly, Director

Division of Peaceful Nuclear Explosives

U. S. Atomic Energy Commission

before

SENATE COMMITTEE ON INTERIOR AND INSULAR AFFAIRS
FEBRUARY 21, 1967

Mr. Chairman I am happy to appear before this Committee today with respect to the Department of Interior's five-point oil shale development program announced by Secretary Udall on January 27, 1967. As you know, point four of that program involved the cooperation of the Atomic Energy Commission in research and development activities designed to investigate the capability of underground nuclear explosions to break oil shale for subsequent retorting in place. The AEC will be glad to continue its cooperation with the Department of the Interior in this very worthwhile undertaking.

The AEC has been working for a number of years with agencies of the Department of Interior, primarily the U. S. Bureau of Mines, on studies and proposed applications of nuclear explosives for peaceful purposes as part of our Plowshare Program. These joint cooperative studies have been concerned with the potential of our developing Plowshare technology for utilization in increasing the recovery of this nation's natural resources. We have been particularly concerned about such resources as oil, natural gas and copper, which occur under conditions where conventional recovery methods are not economical or do not exist. One aspect of the jointly-funded AEC-Interior research effort, which began in late 1963, involves an attempt to determine whether nuclear explosives can be used to advantage in breaking up oil shale followed by retorting the broken shale in place. Results of these experiments are encouraging and lead us to believe that the use of nuclear explosives may provide an economical, efficient, and practical means of recovering and utilizing our vast, though latent, oil shale resources. These experiments have primarily involved above ground retorting of suitable size material by the U. S. Bureau of Mines and site investigation and definition activities of the oil shale deposits with the U. S. Geological Survey and the U. S. Bureau of Mines. I will defer to the Department of Interior as to the significance of the results from this work to date.

As you will recognize, the role of nuclear explosives in the development of a technology for the recovery of oil from shale is related to the ability to break and fracture large masses of rock. In short, the nuclear explosion acts as an underground rock crusher after which we hope that in place retorting techniques can be applied and the resultant liquid oil pumped to the surface.

The explosion initially generates a shock wave, heat and pressure which vaporize the rock to form a cavity that grows until the pressure inside the cavity equals that of the surrounding material.

As the cavity growth stops and begins to cool, pressure inside the cavity decreases and the fractured rock, in most cases, begins to fall to the floor from the ceiling and walls, resulting first in the formation of a crudely hemispheric room. However, this spallation or collapse of the fractured rock continues progressively upward until a stable configuration is reached, usually in the form of a tall cylinder or chimney of broken rock. My second chart depicts some of the resultant chimneys formed in different types of rock. The size of the chimney generally depends on the size of the explosion, the depth at which it occurs and the kind of rock.

Our experience to date with many underground nuclear explosions indicates that the size of rock created by the nuclear explosion would be amenable to an in place retorting process such as that required for oil shale. The final chart indicates graphically how the nuclear in place retorting of oil shale might operate. It shows the chimney created by the nuclear explosion, the injection of compressed air necessary to support combustion, the advance of the combustion zone through the rock fragments which decomposes the Kerogen and the recovery of the petroleum products at the bottom of the chimney.

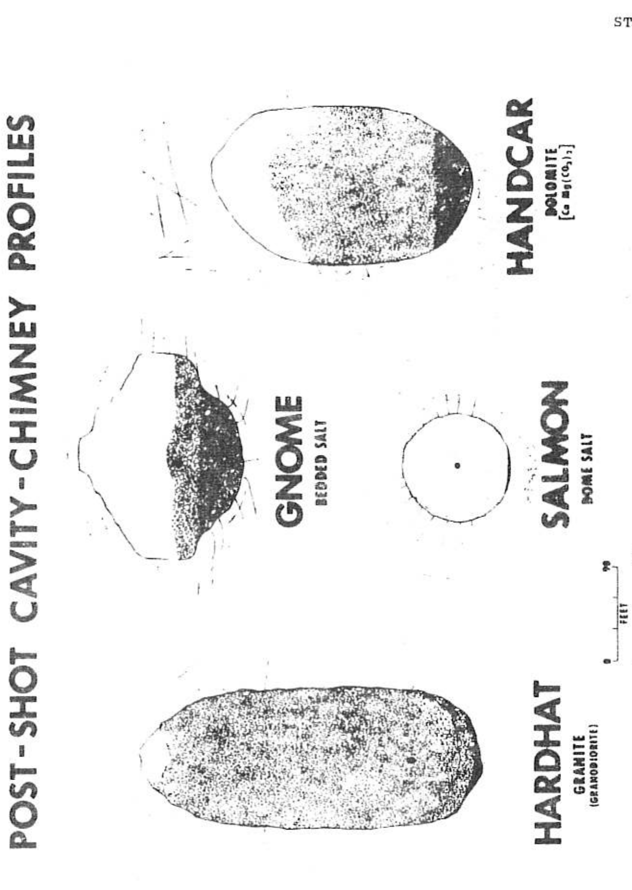
The geological medium or rock type in which the explosion occurs is, of course, an important factor in determining what will result. There has never been a nuclear explosion in oil shale, however we have conducted many nuclear explosions in several other types of rock and have successfully extrapolated the results from one type of rock to another. We have experience to date in six types of rock including alluvium (deposits of unconsolidated sand and gravel), tuff (cemented volcanic ash), salt, basalt (solidified lava flow), grandiorite (granite), and dolomite (carbonate rock). The latter is chemically similar to oil shale.

A seventh rock type in which we expect to gain experience soon is the gas bearing sandstone occurring in the pictured cliffs formation underlying

the San Juan Basin of northwestern New Mexico where we plan to conduct Project Gasbuggy, in cooperation with the El Paso Natural Gas Company and the Department of the Interior. The Gasbuggy experiment is a test of whether nuclear explosions can liberate large amounts of natural gas held in geologically tight underground formations which have a low permeability. Information obtained from Gasbuggy will be of considerable value to us in planning for a specific oil shale experiment utilizing nuclear explosives.

The staff of the AEC and the U. S. Bureau of Mines have only very recently begun a detailed feasibility study regarding the use of nuclear explosives in oil shale in connection with some 25 companies in the oil and gas and related industries represented by the CER Geonuclear Corporation of Las Vegas, Nevada. A list of these companies is submitted for the record. It is expected that the feasibility study report can be completed and a report published this year. Such a report, when completed, may form the basis for any formal proposal the CER combine would wish to make to the Government. In the event such a proposal were made, a very precise evaluation of the technical, safety and other factors of a specific project would be undertaken by the Department of Interior, the AEC, and AEC contractors, including the Lawrence Radiation Laboratory at Livermore of the University of California.

I would like to thank you for this opportunity to discuss the AEC's Plowshare program as it relates to oil shale with you. I will be happy to try to answer any questions you may have.



CHART

COMPANIES CURRENTLY PARTICIPATING IN OIL SHALE COMBINE
ORGANIZED BY CER GEONUCLEAR CORPORATION

- Ashland Oil & Refining Company
- Atlantic Richfield Company
- Cameron & Jones, Incorporated
- Cities Service Oil Company
- Continental Oil Company
- El Paso Natural Gas Company
- Equity Oil Company
- Getty Oil Company
- Humble Oil & Refining Company
- Marathon Oil Company
- Mobil Oil Corporation
- Murphy Oil Corporation
- Pan American Petroleum Corporation
- Shell Oil Company
- Sinclair Oil & Gas Company
- Sohio Petroleum Corporation
- Sun Oil Company
- Superior Oil Company
- Tenneco Oil Company
- Texaco, Incorporated
- The Cleveland-Cliffs Iron Company
- The Oil Shale Corporation
- Union Pacific Railroad Corporation
- Western Oil Shale Corporation
- Wolf Ridge Minerals Corporation

CHART [illegible]

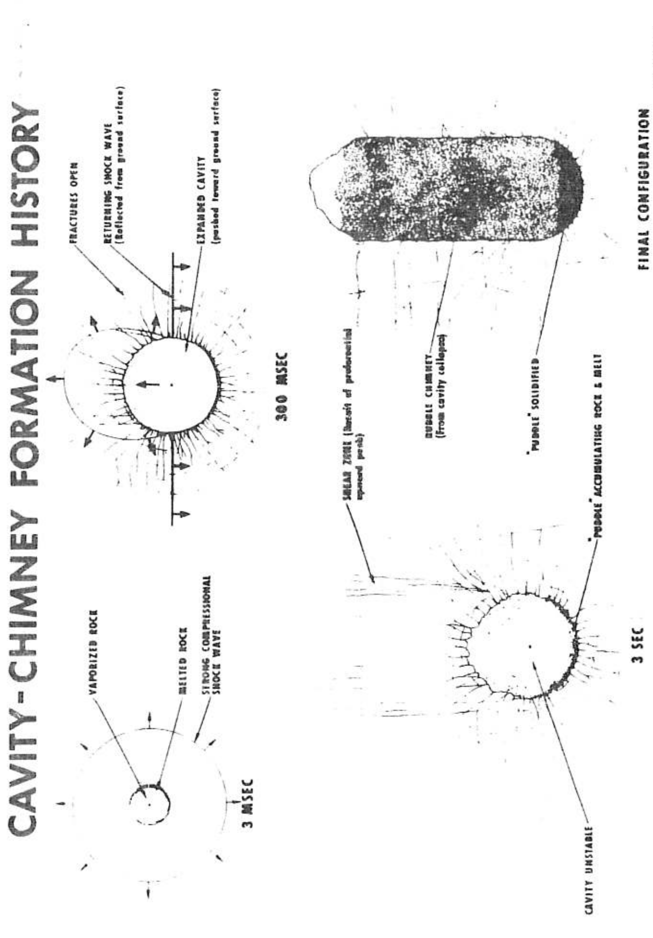

CAVITY-CHIMNEY FORMATION HISTORY
VAPORIZED ROCK
MELTED ROCK
STRONG COMPRESSIONAL SHOCK WAVE
3 MSEC
FRACTURES OPEN
RETURNING SHOCK WAVE (Reflected from ground surface)
EXPANDED CAVITY (pushed toward ground surface)
300 MSEC
CAVITY UNSTABLE
SHEAR ZONE (Remains of preferential upward path)
RUBBLE CHIMNEY (From cavity collapse)
"PUDDLE" SOLIDIFIED
"PUDDLE" ACCUMULATING ROCK & MELT
3 SEC
FINAL CONFIGURATION

CHART 1

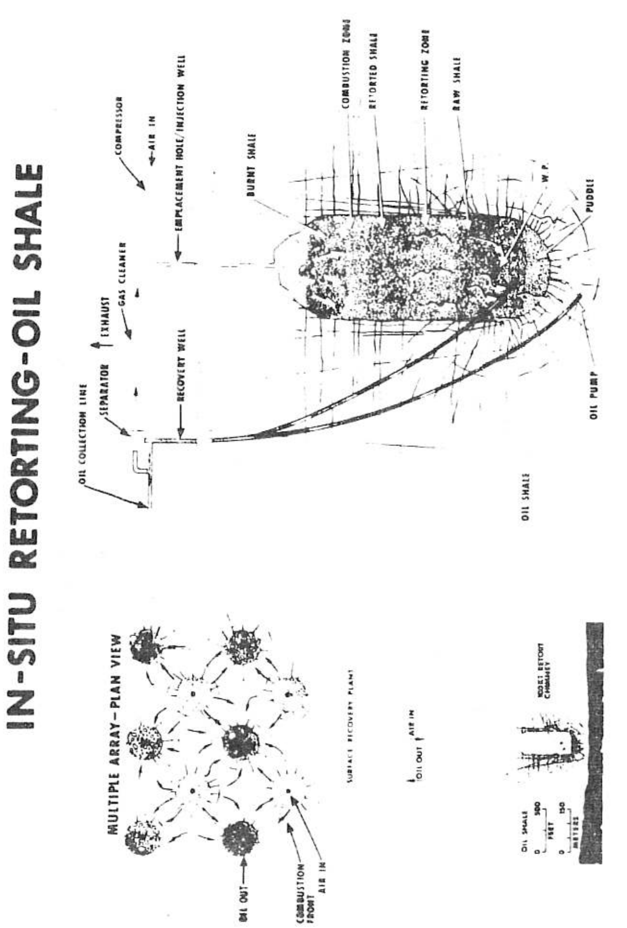


CHART 3

STATEMENT TO THE SENATE COMMITTEE ON INTERIOR AND INSULAR AFFAIRS FOR ITS HEARINGS ON OIL SHALE, February 21, 1967

Joseph L. Fisher
Resources for the Future, Inc.

I am pleased to have this opportunity to present my views on certain aspects of oil shale development policies and particularly the recent five-point program set forth by the Secretary of the Interior. I served as Chairman of the Oil Shale Advisory Board to the Secretary of the Interior which made an Interim Report to the Secretary in February, 1965. I must add that since that time I have followed oil shale questions only in a general way and therefore I am not up to date on the latest technological, legal, and other developments.

I did notice that the February 6, 1967 issue of the Oil and Gas Journal, after noting that our Oil Shale Advisory Board Report hadn't helped very much, said:

> "Udall ended up adopting something like the middle ground espoused by the Commission Chairman."

Although certain differences among the Board members were clearly revealed, our Oil Shale Advisory Board did find good consensus on a number of important matters including: careful protection of land, water, wildlife, and scenic resources in the oil shale country; prevention of speculation and windfall profits from commercial development of the resource; encouragement of competition in the development of oil shale and associated minerals; and assurance that government, at appropriate levels, would share properly in any revenues that resulted. I continue to believe that these, along with the development of the oil shale for future use of the American people, are the essence of the public interest in the resource. Therefore, I was pleased to note that the Secretary of the Interior reiterated these points in his release of January 27, 1967 announcing the five-point oil shale development program.

The difficult and undoubtedly the most controversial part of the Secretary's program is his third point dealing with contracts and lease arrangements for research and development and for subsequent commercial scale development of oil shale. This was the matter over which the Oil Shale Advisory Board split and on which its several members expressed their individual opinions in the Interim Report issued two years ago. Generally speaking, the Board members were arrayed across a spectrum from those who wished to get on rapidly with commercial development of the industry to those who wished to postpone that until much more could be learned through research and development activities rather closely supervised by the federal government. My own position has been characterized as being somewhere near the middle and I think this is a reasonably accurate statement.

Throughout I have thought that we should move toward an active development of the oil shale industry, with careful safeguards for conservation and other elements of the public interest, so that this great resource could make its contribution to the American economy and the well-being of all Americans. I still envisage two stages: first, a period of imaginative and intensive research and pilot plant experimentation in the mining, handling and retorting of the shale; and second, a controlled entry into commercial scale development of the industry under private auspices. This seems to be rather closely in line with what the Secretary has now proposed in his third point.

The first R&D phase can be undertaken through contractual arrangements between the government and private companies or it might be done by granting the private companies [illegible] or R&D leases on small tracts of public land for limited periods of time for specific R&D work. There should, of course, be performance requirements and, even in the small scale R&D phase, careful protection from the conservation and local community viewpoints. The primary object in this phase should be to open up the possibilities for development. Underground in situ techniques should be given special attention because of the inherent advantages of doing the crushing and retorting underground without disturbing the topography. Use of nuclear explosions to fracture the rock underground and provide the heat for extracting the liquid kerogen is one possibility that ought to be explored. The prospects of mining and utilizing the aluminum bearing Dawsonite which is associated with kerogen shale should also be probed thoroughly.

The second phase I envisage, which would be firmed up and would follow the R&D phase, would involve the leasing of tracts of oil shale land adequate to support commercial size operations, still with greatest care taken to preserve the various elements of the public interest which I discussed earlier. In fact, the studies relating to water supply, disposal of overburden, effects of mining operations upon wildlife, scenery, and wilderness, community problems of all sorts, and other matters should be analyzed well ahead of the beginning of commercial development. Also commercial development should be approached in such way that no competent enterprise would be excluded from trying to obtain a lease and get into the business. There would be an advantage for those companies which already had undertaken R&D activities; they would have the experience on which the government, to a considerable extent, would have to rely before leasing public lands. In my statement in the Interim Report of the Oil Shale Advisory Board I went farther than this and said that some advantage might be given to companies undertaking R&D in the ultimate leasing of commercial size tracts so as to

encourage competent firms to come forward and do the necessary and antecedent research and development. One way of achieving this would be to announce well ahead of time that the government would expect to offer for lease bids a few commercial size tracts as soon as the R&D phase indicated that this second step would be warranted, and that it would limit the first round of bids to companies that had actually undertaken significant R&D work.

Well ahead of the second phase of commercial size leasing the government should make clear the kinds of conditions that would be attached to the leases. The government should also be in good communication with those industrial firms, whether from the oil industry or some other, that were interested. In particular, the conservation requirements should be made explicit as early as possible. The royalties that would be collected by the government on each barrel of oil produced obviously would be a matter of great importance as would the level of taxation that would bear on the producers. Precedent exists on these points for both onshore and offshore oil leases on public lands, and in the matter of depletion allowances for tax purposes. It is not entirely clear at what point in the mining-processing continuum the value of the product for depletion allowance purposes would be calculated nor what its level would be. This should be straightened out well ahead of time.

Regarding the other points in the Secretary's program, I have little to add. Obviously the sooner the clouded claims difficulties are settled, the better. The "blocking-up program" makes good sense. Clearly the several bureaus in the Department of the Interior that would be concerned will have to have the funds and capacity to develop the basic information that will be required and to work on the conservation and other requirements that would go along with any lease program.

In conclusion, I believe that the five-point program is a good one at this stage. It is recognized, of course, that a careful mixture of clarity and firmness with flexibility and reasonableness will be necessary. The two phase approach, first of R&D and then later of commercial scale development, seems best to me in terms of conservation of land and water resources in the oil shale region, assuring the public adequate returns on its property, and making it possible for private enterprise to get on with developing the resource in an orderly way.

STATEMENT TO THE U. S. SENATE COMMITTEE
for
INTERIOR AND INSULAR AFFAIRS
by

R. T ECKLES, COORDINATOR
DIVISION OF NATURAL RESOURCES
STATE OF COLORADO
FEBRUARY 21, 1967

On behalf of the deeply interested and concerned citizens of the State of Colorado, Governor John A. Love wishes to express appreciation for the opportunity, through me, to comment on the Five-Point Oil Shale Development Program announced by Secretary of the Interior Stewart L. Udall on January 27, 1967.

We compliment Secretary Udall on his announcement and regard it as a beginning step favorable to the development of our great oil shale reserves. We also are particularly pleased that it contains strong recognition of two facts:

(1) that mounting energy demands in the United States make it imperative that sizable amounts of oil from oil shale begin to flow in the 1970's; and

(2) that immediate action on many fronts is essential to clear away obstacles to oil shale development.

We are also pleased and proud that so much of the five-point program is consistent with the recommendations made by Colorado in early 1964 in response to the Secretary's request for suggestions looking toward the formulation of a program. For your more leisurely perusal we attach to this statement copies of Governor Love's 1964 letter to the Secretary containing those recommendations.

Although three years have passed -- and been lost -- we are satisfied that the positions taken by us in 1964 are still sound. We are anxious, however, to make a refined and up-dated set of recommendations for your consideration promptly after Secretary Udall does what he certainly must do soon, i.e., issue detailed descriptions of how each of the five points of the program will be implemented and carried out.

During the last three years we in Colorado -- and interested industrial concerns -- have not simply been champing at the bit but have been doing all within our power to lay the groundwork for a sizable oil shale industry. Tens of millions of dollars have been spent in private research. The CLAIMANTS ~~applicants~~ have done all in their power to break the legal log jam affecting oil shale mining claim patent applications.

~~Preliminary~~ Attention has been given to the complex problems of financing the schools, roads and community services which inevitably must be provided for what will be mushrooming oil shale communities. Much thought has been given to zoning and city planning so that oil shale communities will be model cities and not cancerous blights.

Colorado has taken a position of strong leadership in the fields of natural resource conservation and the abatement and prevention of air and water pollution. There are problems in all of these areas of great importance to the proper development of oil shale but there is no need to postpone progress until the development by the Department of the Interior of a comprehensive national policy. We are convinced that these matters -- as matters of great local concern -- can be and should be handled at the local level where the problems are and where the people directly affected reside. We intend to do all that is needful in these matters and are satisfied of our ability to do so.

Some problems, however, cannot be solved by thinking, planning and legislation alone. Some problems require immediate and costly implementation now if oil shale development is to occur a decade from now. A prime example of this kind of problem is the absolute necessity for the immediate development of the water essential not only for industrial requirements but for domestic use in the supporting communities. Water development in our semi-arid West is possible -- and will be done -- but it will require huge sums of money and substantial lead time for the construction of the reservoirs and diversion works which will inevitably be required.

The necessary time to solve this kind of problem is irretrievably escaping us day by day. The necessary capital cannot and will not be available unless and until certainty exists that an oil shale industry will be permitted -- not just possible, not just encouraged, but permitted.

This certainty can only exist if there is prompt and full implementation of a strong and purposeful intent on the part of the Department of the Interior and the Administration to remove existing impediments and pursue a program which both protects the public interest and offers reasonable incentives to private capital to participate in this essential venture.

As stated earlier, the five point program announced by Secretary Udall is a Long ~~lengthy~~ step in the right direction. May we ask your invaluable assistance in guiding the remaining steps along a path which will accomplish the goal we all agree must be reached. We in Colorado pledge to continue our best efforts in this great endeavor.

STATEMENT OF CAPTAIN ALBERT STANLEY MILLER, U.S. NAVY RETIRED, AT HEARING ON OIL SHALE DEVELOPMENT BY SENATE INTERIOR COMMITTEE, 21 FEBRUARY 1967

Mr. Chairman and Members of the Committee:

My name is Albert Stanley Miller. I am a retired Captain of the United States Navy. From 1954 to 1960, I was Director, Naval Petroleum and Oil Shale Reserves in the office of the Under Secretary of the Navy, the same position that Captain Moore now holds. During my tenure of office, I became greatly interested in oil shale as a potential source of energy for national defense purposes. It was my thought that an oil shale industry, no matter how small, should be developed in order that, in time of need, the "bugs" of the processing of the oil shale into oil would be ironed out and the perfected process would be available for use by the armed forces. Thus, we would avoid the fiasco which took place at the outbreak of World War II when a crash program came into being to produce synthetic rubber.

Since my retirement from the Navy on 30 June 1960, I have become a consultant in private industry, and I have tried to follow the efforts to develop an oil shale industry. At this point, I would like to observe that, as a former Director, Naval Petroleum and Oil Shale Reserves, I concur heartily in what has been said here today by Captain Moore as to the need for a viable oil shale industry for our National Security and economic development. The members of the Committee will recall that the same basic position was set forth at your 1965 hearings by Captain K. C. Lovell, who was my successor in office.

Now I would like to make a few comments on the program of the Department of Interior which is before you.

First, the Secretary speaks, in point three of his press release of 27 January, of a two-step leasing program. The first part would be, in the Secretary's words, "Access to necessary acreage of oil shale lands for testing purposes". Then, and only then, would "larger tracts for commercial development" be made available.

Mr. Chairman, several companies have pioneered, at their own expense and on private lands, oil shale development. They should have the answer to this question: Is this announced two-step leasing procedure a fixed pattern which must be followed by everyone, one step at a time, or could one who has developed a demonstrated expertise on fee lands, through his own efforts and expenditures, embark upon step two forthwith?

Several companies can be considered as "pioneers". Three that come to mind are the Union Oil Company of California, the Oil Shale Corporation and the Standard Oil Company of Ohio. The pioneer has expended considerable sums in developing oil shale retorting processes using oil shale deposits in privately-owned lands. It does not make sense that the pioneer should have to make a re-run, so to speak, in order to prove his accomplishments. Would the Secretary recognize the pioneer's efforts and accomplishments and make a realistic arrangement with him for the test of truth, namely, commercial production? Of course, it is assumed that the pioneer would provide satisfactory proof to the Secretary that he has, in fact, made these accomplishments.

Mr. Chairman, I want the record to be clear. I speak as an individual who has been interested in developing an oil shale industry for many years, since 1954 to be exact. I do not speak for any company or any industry. I cite the above example as one possible soft spot in the Secretary's program. I emphasize that these pioneers should not be either excluded from participation in the Federal program nor should they be required again to expend their money and time in making a re-run, on public lands, of their achievements.

It would be manifestly unfair to exclude the owners of fee-deposits from full participation in the Federal program or to penalize them for pioneering enterprise. The cost of retorting a ton of oil shale, regardless of oil content, is approximately constant. The main advantage of using Federal lands is that there are more barrels per acre in these lands than there are in most private lands. Thus, the return for money expended in retorting is greater as oil content increases.

As one who has followed oil shale development for many years, I submit, Mr. Chairman, that we are reaching the stage in oil shale that appears to have been reached in the conversion of saline water. You will recall that at your recent hearings authorizing the appropriation of some $57 million in Federal funds for participation in the proposed conversion plant with a capacity of 150 million gallons per day utilizing nuclear energy, Assistant Secretary of the Interior Frank DiLuzio appeared before you and expressed the vigorous position that study, as such, of saline water conversion had reached a point of no return and that what was needed was commercial scale production before further progress was likely to be made.

So it is with oil shale development. I am convinced that the state-of-the-art has advanced to the point that what the Secretary of the Interior should do is to encourage commercial scale production so that we would really know where we stand.

This is the test of truth.

And now, Mr. Chairman, I would like to turn to another point. In addition to the program of the Secretary of the Interior, is there any way that the Congress can help in establishing an oil shale industry? You are aware of the assistance that other countries have given to new industries. Captain Moore has indicated that a plant producing 50,000 barrels per day would require capital investment in the order of $100 million. This is a large amount for the private sector to provide. Congress can assist private industry in getting such a project started not by participation financially since that involves regulation but by making it attractive perhaps in the area of taxes. I provide no suggestions as to the "How", I merely submit that some assistance from the Congress is in order.

And this brings me to my closing remarks. I think the Secretary is to be commended on his policy position that oil shale shall be developed in the historic American tradition -- through private enterprise and private initiative, and that we will not be burdened with outright government participation in the production of oil from oil shale. The history of the development of the mineral resources of the vast public domain of our country irrefutably shows the wisdom of such a course.

This Committee is and can be the key factor in the carrying forward of this great tradition and in the establishment of a going oil shale industry on a sound economic basis.

* * * * * *

STATEMENT OF FRANKLIN WALLICK

WASHINGTON LEGISLATIVE REPRESENTATIVE,
UNITED AUTOMOBILE, AEROSPACE AND AGRICULTURAL
IMPLEMENT WORKERS OF AMERICA
AFL-CIO

BEFORE THE SENATE INTERIOR AND INSULAR AFFAIRS COMMITTEE

February 21, 1967

I am Franklin Wallick, Washington legislative representative of the United Automobile, Aerospace and Agricultural Implement Workers of America, and on behalf of our organization I appreciate the opportunity to appear before this committee to discuss public policy regarding oil shale.

The UAW believes that Congress should move with extreme caution in leasing public land for private development of oil shale. Oil shale deposits may be worth some $300 billion, and at least 85 percent of this is located on public land.

Few Americans today realize how rich they are, and they have every right to know precisely what the implications are of any private leasing of so vast and rich a national resource.

John Kenneth Galbraith, a member of Secretary Udall's oil shale advisory board, issued a warning to which we in the UAW fully subscribe, when he said:

"The American people are not presently aware of the wealth they own in these deposits. It is important both for the conservation and wise and equitable development of these resources, that there be the widest public knowledge of this endowment and the issues concerning their exploitation. An informed public will be a major source of strength to officials seeking sound conservation policies. We urge that all conservation-minded members of the Congress and the public inform themselves fully on this vast resource and policies concerning its use."

Those words were written two years ago. They are still true today. The American people are in the dark about oil shale and what it means to this nation. These hearings are a welcome opportunity for the public to understand better the consequences of government policy on so rich a public treasure.

Speaking strictly as lay members of the public, there are several questions we feel worth raising at this juncture:

1. A totally new allocation of royalties should be made if any oil shale leasing is undertaken. In our view it is unsound public policy for 52½ percent of all royalties to go for reclamation purposes, 37½ percent for the respective state, and only 10 percent to the federal government.

With the enormous demands for federal funds to rebuild our cities, acquire land for outdoor recreational purposes, combat air and water pollution, and the financial needs of modern education, we believe Congress must come up with a modern allocation of royalties if oil shale deposits are leased.

2. We question if leasing of surface deposits at this time is desirable. It would be a great tragedy for the whole nation if Colorado and Wyoming came to look like parts of West Virginia and Kentucky which bear the ugly scars of and to this day are being disfigured by strip mining. It would be much wiser to experiment with safe underground recovery methods and demonstrate their feasibility before surface mining is permitted.

3. While strictly developmental leasing may be wise and necessary now, the federal government should have the right to renegotiate any leases on public land once a feasible claim is operating, so the public interest will be fully protected. The present 12½ percent royalty on publicly-owned oil and gas deposits may be justified, but this may prove later to be much too generous to the commercial oil companies. Any leasing arrangement on public land ought to be subject to review so the public interest is fully protected.

4. Great caution should be taken not to damage watersheds and wildlife which could be irrevocably destroyed by reckless leasing.

So finally, Mr. Chairman and members of this committee, we urge Congress to move with great caution on oil shale; to review royalty allocation so the nation's neglected social needs will be helped; develop safe underground recovery methods before scarring the surface; protect the public interest by a review of the present 12½ percent royalty; and protect watersheds and wildlife.

Congress has a great opportunity to prevent the mistakes which led to the Teapot Dome scandals of another generation.

Congress also has a great opportunity to use an immense national resource to advance education for millions of American young people and other worthwhile programs to improve the quality of life for all Americans by dedicating oil shale royalties for these special purposes.

STATEMENT BY JAMES H. SMITH, JR.

FOR THE SENATE COMMITTEE
ON
INTERIOR AND INSULAR AFFAIRS

My name is James H. Smith, Jr. and I represent the Wolf Ridge Minerals Corporation. The views I am expressing are endorsed by our associated companies, Advance Ross Corporation, the Utah Shale Land Co., and Colorado Minerals Corporation.

We appreciate this opportunity to comment on the Five Point program for oil shale development which was announced by the Secretary of the Interior on January 27, 1967.

BACKGROUND OF WOLF RIDGE MINERALS CORPORATION

Wolf Ridge Minerals Corporation is a Colorado corporation engaged in development of natural resources, principally in Western Colorado, Utah and Wyoming. The Company is committed to the objective of participating in the creation and orderly development of an integrated mineral-chemical-industrial complex. The Company's management and stockholders frimly believe in the feasibility of this concept, and that such a development would bring significant benefits to the United States and to the individual states involved.

The Company's technical and field operations are headed by Irvin Nielsen, a geologist who has been active in evaluating the geology and mineral resources of the Green River Formation for the past ten years. The Company's research efforts are under the direction of John Savage of Rifle, Colorado, a chemical engineer who has been engaged in the investigation and development of mineral resources for over twenty years.

Both Mr. Nielsen and Mr. Savage are members of the Corporation's Board of Directors. The other member of the Board are Samuel R. Freeman, partner in the law firm of Van Cise, Freeman, Tooley & Eason, attorney for the Colorado Oil and Gas Conservation Commission since 1954, and also formerly Assistant Attorney General of Colorado; Arthur S. Bowes, Jr.

(Chicago, Illinois), investments and financial consulting; John P. Boynton (Milwaukee, Wisconsin), investments and oil and gas interest, and myself. I have been active in the development of western resources for twenty years and have served the Federal Government as Assistant Secretary of the Navy and Director of the International Cooperation Administration.

Wolf Ridge Minerals Corporation is an independent company and is not controlled directly or indirectly by any other company. It is associated with several other companies, however, in some of its work. In addition to its own staff, the Company has made extensive use of outside consulting laboratories and experts.

The reason for appearing here is that the company has completed, in the last three years, sufficient geologic, process and economic research on Green River formation strata to prove that its sodium exploration permit cores represent valuable discoveries of nahcolite, dawsonite and other minerals. The minerals in this formation will yield alumina, soda ash, oil and organic chemicals and can be produced from the same raw material produced from the same mine.

Wolf Ridge Minerals Corporation has developed, in the laboratory, a series of processing techniques which can separate and produce each of the above minerals. These can generally

be described as follows:

1. Mined rock is CRUSHED AND selectively screened to remove a range of "fines." The mineral nahcolite will be concentrated in the fines because of its tendency to crush to finer particles than the tougher or more elastic host rock.

2. The nahcolite fines or concentrates will be sent to a soda ash section for processing.

3. The remaining crushed rock (about 80% of the total) will be routed to the retorts for recovery of condensible hydrocarbons and conversion of dawsonite to a more soluble sodium aluminum oxide.

4. The retort ash will be sized by a SIMPLE crusher for an optimum leaching. The retorted rock has a very low strength and can be inexpensively reduced in size.

5. The properly sized material will be leached with a mild caustic solution for a short interval of time. Laboratory test results to date show that this process has recovered up to 95% of the available aluminum. The residue is easily washed and the solution easily filtered because the rock does not contain a hydrated clay. Also, since no high pressure-high temperature digestion techniques are involved, the QUANTITY OF dissolved IMPURITIES IS SMALL

6. The final waste "LESS THAN 50% OF ORIGINAL MATERIAL" will be sent to a tailings pond.

7. The "pregnant" alumina and soda ash bearing solutions CAN be treated by conventional means to extract

soda ash and alumina. The solutions can be recirculated to build up alumina and soda ash concentrations because of the ease of leaching and washing the granular rock and the ease of filtering the solution.

OFFSETTING THE RELATIVELY low alumina concentration, ARE THE advantages of low cost per ton and ease of crushing, leaching, washing, and filtering WHICH combine to make the rock appear to be an economically attractive source of alumina. The processing of nahcolite is greatly simplified by being able to mechanically separate the rock from the nodular nahcolite, and the retorting to recover oil is economically enhanced by removing the essentially non-oil-producing nahcolite.

Our work has included a careful, but not complete, investigation of the Piceance Basin. Our exploration and coring was done during the period April 1964 to April 1966, under sodium prospecting permits issued by Interior. In April 1966, we filed, pursuant to the existing laws, for sodium preferential right leases on the basis of the minerals found in our cores. At that time there was a NEWSPAPER REPORT that the minerals found were locatable rather than leasable so we were obliged to go out and stake claims.

Consequently, we believe we have taken all the action that could possibly be required of us by any interpretation of the law to permit the next phase of activity. In addition to following the procedures prescribed by law, we have made a presentation to the Secretary of the Interior - verbally on

December 7th, 1966 and in writing on January 10, 1967, outlining what we call the "multiple minerals" approach to the problem of developing the Piceance Basin.

I should say here that we did not invent this approach - the nature of the deposit happily forces it on us, because, in our opinion, IN SOME AREAS the raw material will convert to its maximum value only through processing all of its major components. It may also be economically productive only if this is done. In other words, the profitable recovery of any one of these minerals could be interdependent on the recovery of the others. COMMENCING WITH THE MINING much of the route travelled by most of the material is the same and therefore those COSTS are spread amongst the several end products instead of solely against one.

In any case, the "multiple minerals" approach is new and is made possible because of the discovery of the additional minerals. We do not offer it in any way that would exclude other approaches.

We must emphasize that our work is in the laboratory and LIMITED. We have, at the moment, only a very small quantity of dawsonite, although we have almost all there is immediately available. For this reason, we do not suggest any diminution of other efforts to develop the total resources, with which your committee is concerned. We realize that the atomic explosion and the in situ process are not compatible in close proximity to the multiple mineral process but fortunately there is a vast area in which various EXPERIMENTS can be tried without interference. We urge encouragement of all efforts, bearing in mind that the progress of this country has been due largely to those who were willing to risk financing experiments which did not promise immediate success and to the fact that all of us do better when under reasonable competitive stress.

The Interdepartmental Energy Study Report of the Office of Science and Technology stated "It is important to learn more about the origin, characteristics, and distribution of oil shales and carbonaceous rocks." We feel we have made a contribution to this, and that there is much more to be investigated by ourselves and others.

It may be useful, however, to give briefly the history of the research on dawsonite which has preceded this meeting.

The existence of dawsonite in the Green River Formation of Colorado was first noted by Dr. Charles Milton of the U.S. Geological Survey in 1959. The first INDICATION of the quantities of dawsonite in this area was acquired from work conducted by John Ward Smith of the U.S. Bureau of Mines, which he reported in 1963. The first suggestion that dawsonite be considered an ore for aluminum was made by Irvin Nielsen and John Savage of Wolf Ridge Minerals in November of 1965.

Subsequent work by our company, the U.S. Geological Survey, the Bureau of Mines, Kaiser Aluminum and Chemical Corporation, Dr. Anthony of the University of Arizona, Dr. Hay of the University of California, Kilpatrick Laboratories of Denver, Hazen Research Inc. of Golden, Colorado, Cameron & Jones of Denver, and other research organizations has confirmed that dawsonite may well be a new source of aluminum.

It might have remained undisclosed for many years if these public lands had not been opened specifically for exploration for sodium deposits. Now we - industry and government - are faced with the challenge of how to make this deposit into a marketable national asset.

Continuation of our investigations awaits issuance of the leases by the Secretary of the Interior. Our two-year prospecting permits expired April last year and we look forward to resuming our work early this spring under appropriate authorization from the Government. Point ONE of the Five Point Program, announced on January 27, 1967, states that "Pending sodium preference right lease applications will be promptly considered on their merits." We appreciate this. We are anxious to resume core drilling on a larger scale to obtain more dawsonite both for our own use and that of the Bureau of

Mines, with whom we anticipate cooperating closely. We seek no special rights or privileges and have applied for Standard Form 4-1134 (March 1964) leases. Our only comment on POINT ONE is that we believe the most careful consideration should be given to the question whether or not sodium should be returned to withdrawn status. If Executive Order 5327 of April 5, 1930 had not been modified to permit the search for sodium minerals, we would not be where we are today. We suggest that reverting to withdrawn status may deter rather than encourage exploration.

It is understood that a number of companies are interested in the "blocking up" provision of POINT TWO, so we will not comment on them. OUR LEASE APPLICATIONS ARE NOT INVOLVED.

POINT THREE appears to foreshadow an entirely new relationship between the government and interested companies. If it means there will be individually negotiated contracts between the Department of Interior and each interested company, it appears that we are moving from the time-tested provisions of the leasing law to what may be a very difficult administrative task.

We also do not believe industry can be expected to undertake the research - to say nothing of the infinitely more costly development - without the firm commitment of a lease. Certainly such a lease could be revocable if the lessee did not produce, but its issuance must be assured. We also

feel that this whole area is too new to permit requiring a company to "describe the process sought to be developed." This is the antithesis of research. Our own approach would be to undertake the job of developing our present process or finding a new process without starting with preconceptions, fixed plans, etc. We believe in confronting today's problems with tomorrow's technology.

On POINT FOUR we welcome the enthusiasm and know-how of the Atomic Energy Commission and its associated private companies. We are fortunate that the development of clean weapons permits the use of atomic explosions for such peaceful purposes as this. Other in situ processes should be pursued simultaneously, just as one form of mining should not prevent the investigation of another - for example, WE ANTICIPATE ONE METHOD OF MINING EVOLVING INTO ANOTHER.

On POINT FIVE we certainly agree with the objectives but we are not sure what is meant by "Some of these research projects will involve close cooperation etc." We feel the issue of where and under whose management the research is to be done should be faced now. This is an age-old problem -- "in house research." We suggest it is in the national interest to ATTRACT INDUSTRY'S best research institutions and to avoid any single-source direction of the research. The chairman (Senator Jackson) of this Committee, however, has had so much experience and success in generating good research that we should make no comment.

More research will be needed. The amount of FUNDS which will become available for this will depend on the government's policy decision on the relative importance of developing these minerals. These funds may come from congressional appropriations, from industry, or both - but in any case only in amounts that will depend on what importance is given the matter by the Government.

In the energy field, in 1965 the Government spent 11 million dollars on coal research, 40 million on oil and gas, 210 million on nuclear (not including military and space oriented appropriations.) Industry spent the same amount on coal, 9 times as much on oil and gas, and less than half as much on nuclear. Thus there is great disparity in the R. and D. efforts in the different segments of the energy sector. This means some segments will progress more rapidly than others. It evidences a national policy decision to develop certain types of resources in preference to others. This will determine to a large extent the mix from which we will get our total BTO's in 1980 - coal, oil, gas, nuclear, solar, etc., all of which are competing for a share of this market.

At some time, the Government is making important policy decisions as to where geographically we will obtain our energy. Onshore, offshore, the North or South American continents, Africa, the Middle East, etc., all again vigorously competing for a share of the market.

The Secretary of Interior's Five Point shale program is designed to give shale at least a starting position in this race between energy sources. This is most welcome.

The announcement of the program refers to the report of the Oil Shale Advisory Board dated February 1965, and part of the program stems from the alternative courses suggested by that Board.

In the two intervening years, events have occurred which we believe most effect some of the conclusions and recommendations of that Board. The Board agreed that "oil shale development is not urgent to provide supplies of liquid fuel for the immediate future." Since that statement the American oil industry has suffered MANY REVERSALS in its relationship with the foreign countries in which it operates.

Our oil companies have been subjected to the following types of unilateral actions (specific examples can be furnished.):

1. Abrogation of existing contracts.
2. Revision of tax rates for future.
3. Revision of tax rates retroactively.
4. Unilateral decision on the price of the commodity to be used for tax base, regardless of actual market price.
5. Increase in transit charges.
6. Unilateral decision as to the amount of commodity to be sold, regardless of condition of the market.
7. Seizure of local bank deposits of any company not complying with these decision.

8. Seizure of all facilities of a foreign company.

9. Termination of concession and all contractual obligations.

10. Imposition of fines greater than the value of the company's property in the country.

11. Use of discrimination to place some companies at a competitive disadvantage.

12. Insistence that the headquarters of the foreign company be in the host country.

In this two year period five foreign countries have levied retroactively over $450 million in taxes.

The additional taxes paid to these foreign governments are dollars right out of the Treasury of the United States, because they are a tax credit deductible directly from taxes which otherwise would be paid to the United States.

We doubt if this situation can be remedied by any means other than the availability of a new alternate domestic supply of oil. Assuming it will take ten years from the date of the Government's "GO" signal to achieve significant production of oil from the Green River Formation (or any other new domestic source) we are already exposed to a long period of adverse actions.

This is a matter of national concern and while many of the directors and officers of this company are local Colorado people, their interest is far from local. Individually for many years they have watched the increasing reliance of the United States on foreign sources of raw materials in the face of a rising spirit of nationalism. During this period disturbing trends have been apparent in the following areas:

1. The national debt.
2. The balance of payments.
3. The gold reserve.
4. The reliance on foreign flag shipping to handle our peacetime imports.
5. The need for a continuing major anti-submarine effort to assure the safety of such shipping as will be at our disposal in wartime.
6. The migration of U.S. industry with a reduction in job opportunities in the U.S.A.
7. The determination of countries now furnishing raw materials to engage in the processing themselves.
8. The availability of cheap power through nuclear energy to countries heretofore believed to have no economic potential.
9. The entry of the Soviet Union into the oil and gas market primarily on a barter and long term government to government trade agreement basis.

These trends and conditions which we consider unfavorable can be REVERSED by policy decisions of the United States. At least 100 billion dollars of new capital will be invested in the oil industry in the next ten years. Whether this investment will tend to ease or increase our problems will depend largely on the policy adopted for our own natural resources.

The second important change since the Board's report in 1965 has been the recognition of the dawsonite, nahcolite and other minerals potential.

While neither the Department nor anyone else knows the extent of the deposits of "other minerals" it is more than probable that the usable dawsonite and nahcolite deposits are smaller horizontally than the 16,000 square miles of the Green River Formation. It is certain that these deposits occur only in a fraction of the total vertical deposit of shale. It is certain from the Wolf Ridge Minerals cores that these deposits are large when considered by themselves, but small QUANTITATIVELY when considered in relation to the shale deposits.

It is reasonable to assume, therefore, that two very different types of deposits must be dealt with - one composed of shale, dawsonite, nahcolite and possibly other minerals, and the second being without dawsonite and nahcolite. This calls for very different treatment of the two deposits from both a legal and technical point of view.

Without going into detail on the law at this time, the difference here is evidenced by the separate treatments historically given shale and other minerals by the Department under withdrawal orders and other administrative actions, as well as by the variety of laws applicable to the specific minerals. The Wolf Ridge STUDIES AND cores indicate that some areas OF THE GREEN RIVER FORMATION may be chiefly valuable for shale, some for other minerals and some may contain shale and minerals which individually are valueless but jointly may be commercially feasible. This has inescapable consequences. Whether or not there is a need to accelerate the development of the shale oil process, the need for a domestic source of alumina must be considered. Our aluminum industry is far more vulnerable to unilateral actions of foreign governments than the oil industry. Almost 90% of our bauxite comes from abroad - from a few countries whose need and desire to strengthen their own economy is no less than that of the oil producing countries. Canada, from whom we import both aluminum and oil, has to import both from these same countries to supply us.

Aluminum is also almost as critical a material in both our peacetime and wartime economies as oil. Consumption is rising rapidly, its availability has steadied prices of competitive material, and the Government has spent substantial sums encouraging search for new sources, both within and without the United States.

We believe the present government policy with regard to aluminum is:

a. to promote a competitive industry

b. to encourage the entry of new producers

c. to protect the small non-integrated consumer of ingots or semi-fabricated aluminum.

"Mineral Facts 1965" states that:

"The maintenance of adequate aluminum supply requires assured ore supplies. It also requires acquisition of adequate quantities of low cost electric power. And, thirdly, it requires a decrease in the high-energy consumption in producing aluminum."

We believe we are advancing a project which serves the policy objectives and which has both the assured ore supplies and the necessary low-cost power. It is hoped also that we will be able to show that the high-energy consumption in producing aluminum from bauxite will be reduced when the process commences with dawsonite.

With regard to the Secretary's five additional objectives - encourage competition, prevent speculation, promote conservation, encourage fullest use, provide reasonable revenues to Federal and State governments - we are for all of them. We are very conscious of the public interest in these resources, and feel that this will be served well by an action program given impetus by Congress and the Department of Interior and carried out forcefully by imaginative and competitive segments of American industry.

I would like to close with a statement on our present activity. We are awaiting reply to our application for leases. We have used up practically all of the dawsonite from our cores in experimental work, and expect now to continue the work on dawsonite obtained from deposits outside the United States, until such time as we receive the necessary authority to proceed on the Federal lands. We are also working on water and power supplies; on community planning and, with the State, on conservation and pollution control.

I appreciate this opportunity to appear before your Committee and would be glad to answer any questions.

STATEMENT BY SENATOR WALLACE F. BENNETT, R-UTAH
BEFORE SENATE INTERIOR COMMITTEE, FEBRUARY 21, 1967
AT OIL SHALE FACT-FINDING HEARINGS

OIL SHALE--A GREAT POTENTIAL

Mr. Chairman and members of the Committee, I would like to thank the Committee for this opportunity to present my views to this distinguished committee as it begins hearings on the Federal oil shale program and policies.

It has been my privilege to testify before this Committee before regarding Oil Shale and to explain my views on this very important subject which has so much great potential economic impact to the areas involved and which also may have a great bearing on our National Security.

Since the last hearings held in May of 1965 the Interior Department has come forward with a so-called Five Point program which would foster the oil shale development in Colorado, Wyoming and Utah.

I was generally pleased with the announcement that the Interior Department has finally acted to take the first step toward unlocking one of the richest oil deposits in the world.

I hope, however, that after almost 40 years of confusion and delay we are not merely getting into a situation where the Department is "beginning to study how to start to commence," as has been said of the Interior Department and oil shale.

Mr. Chairman, I have felt for a long time that there have been three obstacles to early progress toward oil shale development.

1. The lack of clear-cut and workable leasing regulations that could permit and foster development.

2. Uncertainty as to the validity of many of the mining claims which were filed many years ago and which are clouding the picture today.

3. Delays and problems confronting the economic development of oil from oil shale deposits.

Of these items the third has been making the most progress toward solution while the other two have been bogged down in bureaucratic red tape.

Now it appears that some of that tape might be cut as result of the new policy decision handed down in January. However, before any concrete statement can be made or before this Committee can decide exactly which direction the Interior Department plans to go a study must be made of the regulations which the Secretary of Interior promised (in Point Three) within 60 to 90 days when we will see the administrative details of leasing procedures.

-more-

I am sure that the rest, private industry and all concerned with our national security will await the Interior Department details on the proposed leasing program with a great deal of interest.

Although it remains to be seen I will be particularly interested in just how many Federal strings will remain attached to the land in question and in knowing whether the Administration has chosen to inhibit rather than to promote the cooperation of private industry into this very important field.

In addition, I am wondering about the question of state indemnity selections which play such a major role in the Utah land picture. I hope that the Secretary, as result of these new policy statements, will come forward when the regulations are printed and expedite the indemnity selections that the State of Utah has requested.

It is my feeling that the government should immediately make certain areas available to private concerns for development. A logical beginning would be an area where there is intermingled state, Federal and privately held fee land.

Oil companies and others have requested or applied for leases on more than 100,000 acres of Federal oil shale lands. In Utah, practically all of the oil shale lands owned by the state--some 160,000 acres, were under lease at the end of 1963.

The opponents to an immediate leasing program maintain that we have not traveled far enough in the research and development area. They say that more research is required before we will be able to open up this industry. Private industry claims it has the methods and that all it needs to get going is someone to cut the red tape. I maintain that we should allow private industry to prove its claims and let us not hide behind a curtain called "lack of research and development."

Mr. Chairman, in conclusion I would like to say that I hope, at long last, that we are on the road to clearing up some of the confusion that has been created by changing attitudes in this entire oil shale area.

The subject has been studied almost to death by almost every branch of the government. One of the major problems has been the failure by the government to act as quickly as it should have so that the development of this resource would not have to commence under the pressure of shortages or merely to conditions of the day. I would hope that we can proceed in the orderly and equitable development of this industry in an independent and positive manner based on careful and comprehensive policies that will give oil shale a chance.

Thank you, Mr. Chairman.

####

THE "PROJECT GASOLINE" PILOT PLANT

The following description of the Consolidation Coal Company pilot plant for making gasoline from coal (at Cresap, West Virginia) is an attempt to describe the process in depth in a form that can be understood by the nontechnically oriented. This is the first major pilot plant to be erected under OCR funding.

I. Introduction

The purpose of Project Gasoline is to develop the Consolidation Coal Company's Synthetic Fuel Process for converting coal to liquid fuels such as gasoline. Coal consists of very large molecules, deficient in hydrogen, rich in carbon, and containing various mineral impurities. On the other hand, liquid fuels, such as gasoline, are relatively rich in hydrogen, relatively free of impurities, and are of a molecular size perhaps 1/20 that of coal. The problem is to combine the coal molecules with added hydrogen in such a way that the impurities are removed and gasoline is produced in an efficient manner.

The conversion of coal to gasoline is not new. Much of the liquid fuel used by Germany in World War II was manufactured from coal. However, the techniques employed by the Germans were quite cumbersome and inefficient, and the German processes would be completely uneconomic in the United States today.

The Consol Synthetic Fuel Process is a novel process developed in this country over the past 10 years. The processing steps have been evaluated in bench-scale equipment, and the present pilot plant has been built to confirm the bench-scale information. The plant has a feed capacity of one ton per hour of coal and will produce approximately 60 barrels of liquid products per day. While this is too small a scale to be economic for commercial purposes, it is sufficient to determine the feasibility of the process and provide commercial design information. (See Illustrations A and M.)

II. Coal Preparation

In the first step of the process, coal must be dried to eliminate water vapor and then crushed to particles approximately 1/8-inch or less in size. This is done in conventional crushing and drying equipment used by many other industries. Minus-4-inch wet coal is crushed in a hammermill. It then goes to a cyclone system in which the fine coal, after drying in hot gases, is recovered. (See Illustrations B, C, and D.)

III. Coal Extraction

The coal-extraction section divides the coal into (1) a reactive, ash-free portion suitable for further processing into gasoline and (2) a residual portion containing ash and other impurities.

To make this separation the prepared coal is mixed with a hydrocarbon solvent to form a slurry, which is then pumped to a fired preheater and elevated in temperature to 725-750° F., after which it passes to the extractor. The pressure of the system is maintained at about 500 pounds per square inch to prevent any of the solvent from vaporizing. Under these conditions and with sufficient residence time, approximately two-thirds of the coal dissolves in the solvent.

The stream leaving the extractor contains undissolved coal particles, solvent, and dissolved coal (extract). It is necessary to separate the undissolved coal particles from the mixture. This is done by passing the extractor effluent through continuous rotary filters. These filters, operating at elevated temperatures and pressure, retain the undissolved coal on the filter cloth and permit the solution of extract and solvent to pass through. The filter cake, after being washed with solvent, is removed continuously from the cloth and is fed to a solvent recovery section. The filtrate, consisting of the desired extract plus solvent, is distilled to remove the solvent for recycle. (See Illustrations E, F, G, H, I, and J.)

IV. Solvent Recovery

Recovery of the considerable amount of solvent present in the filter cake is accomplished by heating the cake with hot gases in a closed vessel to approximately 800-900° F. Under these conditions the solvent evaporates from the undissolved coal particles and is recovered by cooling and condensation. The solid particles at the bottom of the vessel and in the dust collectors are removed, cooled, and discharged from the system.

The undissolved coal particles still contain combustible material suitable for generating steam in a conventional power station. In a commercial application of the process these solids would be sent to a nearby power station to provide a low-cost fuel. (See Illustration H.)

From: Office of Coal Research
Annual Report, Feb., 1967

V. Solvent Distillation

The hot liquid filter effluent is processed to remove solvent from the extract before the addition of hydrogen. This is done in conventional distillation towers. Under controlled temperature and pressure conditions the solvent evaporates from the solution and is collected overhead in the distillation tower. The high-boiling-point extract is recovered from the bottom of the tower as a liquid. (See Illustration I.)

VI. Extract Purification

The recovered extract (under certain conditions) may contain trace quantities of mineral material too fine to be removed by washing the extract with hot water. The hot wash-water is separated from the extract in decanters after washing. Since water and extract do not dissolve in each other, it is possible to effect a clean separation of the impurities and water from the extract before it is hydrogenated. (See Illustration J.)

VII. Extract Hydrogenation

After the extract has been separated from the coal impurities and the solvent, it is ready for further processing to convert it to lower-boiling-point hydrocarbon oils. This is done by reacting the extract with hydrogen over a catalyst at temperatures of approximately 800° F. and pressures of approximately 3000 p.s.i.g. in a high-pressure reactor.

The extract enters the reactor as a liquid and flows upward at a velocity which permits the suspension of solid catalyst particles in this vessel.

Gaseous hydrogen is bubbled into the bottom of the vessel. In the presence of the catalyst the hydrogen reacts with extract to form lower molecular weight hydrocarbons which vaporize and are removed from the top of the reactor. To achieve a maximum conversion of extract to distillate hydrocarbons, four reactors are employed in series.

For good process economy the hydrocarbons produced by reacting hydrogen with extract should be predominantly in a relatively narrow boiling range, so as to minimize production of low-molecular-weight hydrocarbons such as residual fuel. To achieve the desired selectivity, it is necessary that the pressure, temperature, and catalyst activity be carefully controlled in the extract hydrogenation step. (See Illustration K.)

VIII. Distillate Fuel Recovery

The products from extract hydrogenation are unreacted hydrogen and a broad spectrum of hydrocarbons varying in molecular weight from that of methane to that of heavy kerosene. This product mixture must be cooled to permit the recovery of the unreacted hydrogen for further use and the separation of hydrocarbons too low in molecular weight for further processing into gasoline. This is done by a series of cooling and pressure-reduction steps, followed by a conventional fractionating tower. The recovered oil from the tower--consisting of hydrocarbons having boiling points in the range from those of butane to those of heavy kerosene--is the liquid product from the Consol Synthetic Fuel Pilot Plant. A portion of this product is separated and recycled to the coal extraction step to act as a solvent in the process.

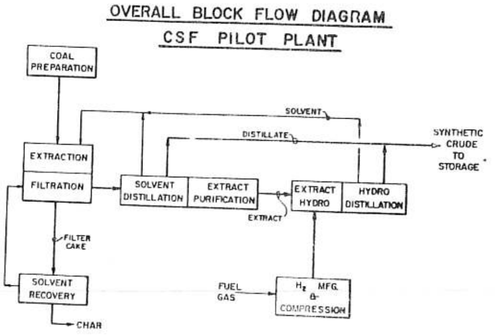
The resulting product is suitable for conversion to gasoline and other liquid fuels, using conventional petroleum refinery processes. Such processes are already developed and have not been included in the pilot plant for study; instead, samples of the pilot plant product will be shipped to existing petroleum-processing pilot plants to produce the final desired liquid fuels.

IX. Hydrogen Manufacture

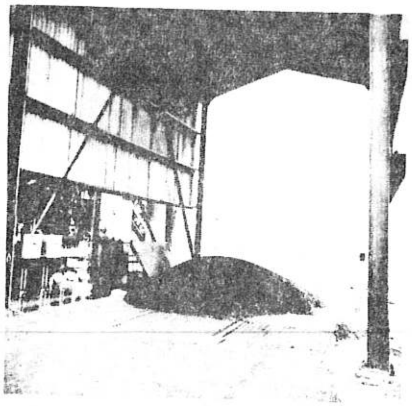
The final step is manufacture of the hydrogen needed to react with the extract. In the pilot plant, hydrogen is produced by the reaction of natural gas (methane) with steam over a catalyst; this is a commercially-developed process now widely used in the United States. (See Illustration L.)

Hydrogen can be made from raw materials other than natural gas; for example, undissolved coal from the extraction step can be utilized for this purpose. Other processes to make hydrogen from coal economically are being developed under other OCR contracts and are not yet sufficiently advanced for inclusion in the present pilot plant. The commercial embodiment of the coal-to-liquid fuel process may, however, include such new hydrogen-generating methods.

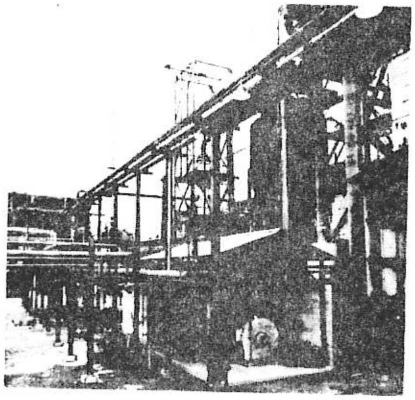
From: Office of Coal Research
Annual Report, Feb., 1967



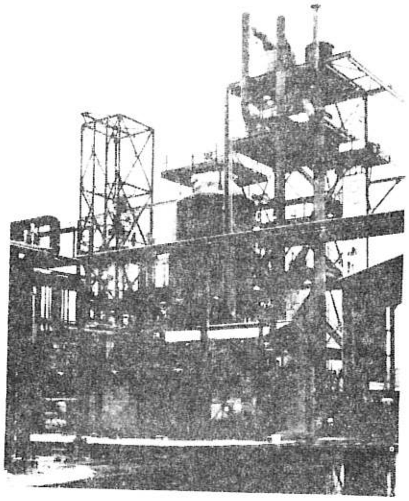
(A) BLOCK FLOW DIAGRAM
CSF PILOT PLANT



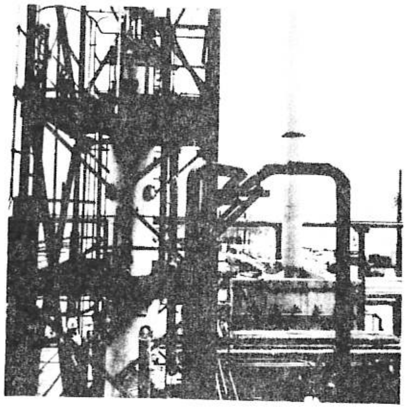
(B) COAL RECEIVING STATION



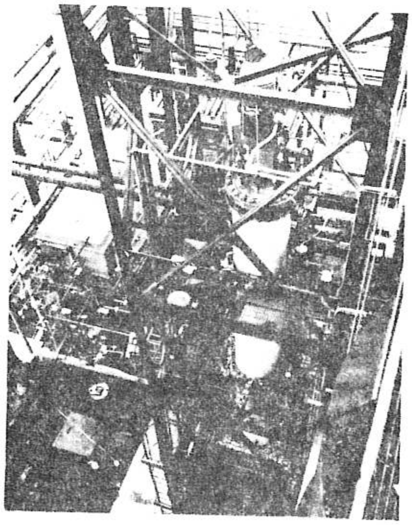
(C) COAL CRUSHING



(D) COAL DRYING AND STORAGE

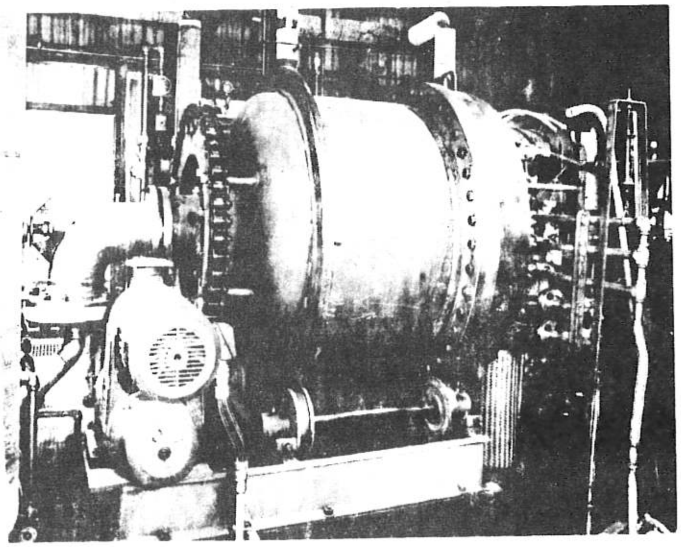


(E) FIRED PREHEATER TO RIGHT
EXTRACTOR TO LEFT

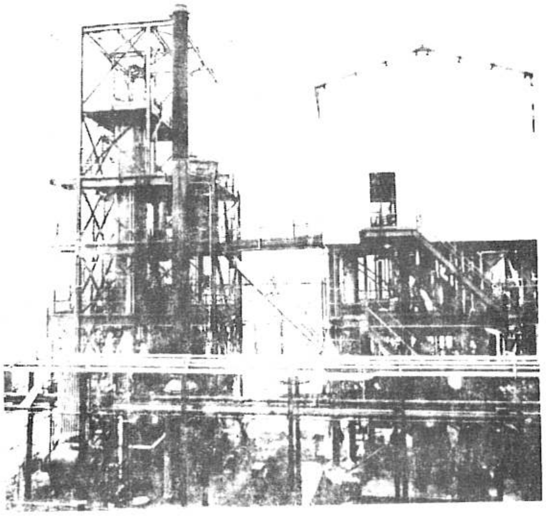


(F) TOP VIEW OF EXTRACTOR

From: Office of Coal Research
Annual Report, Feb., 1967

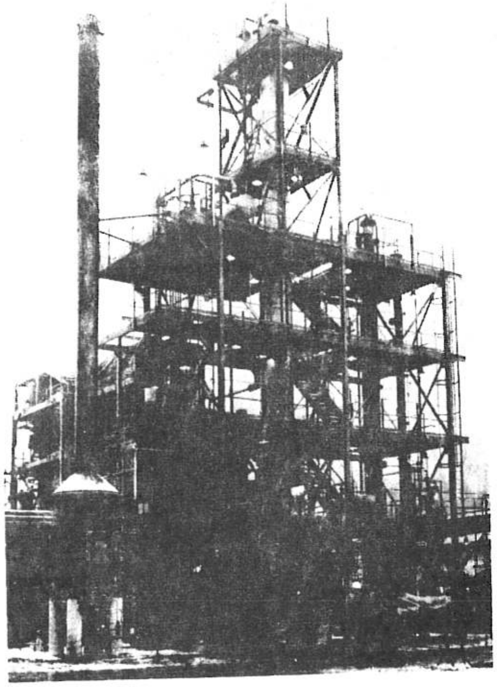


(G) CONTINUOUS ROTARY FILTER

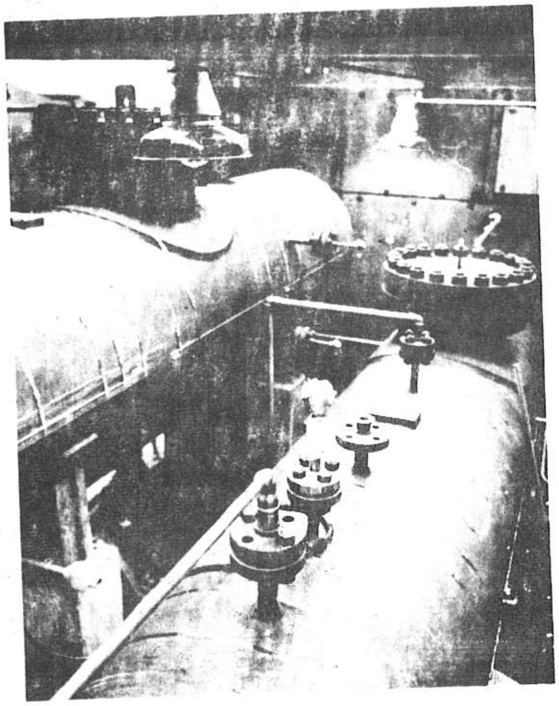


(H) LOW TEMPERATURE CARBONIZER SYSTEM TO LEFT

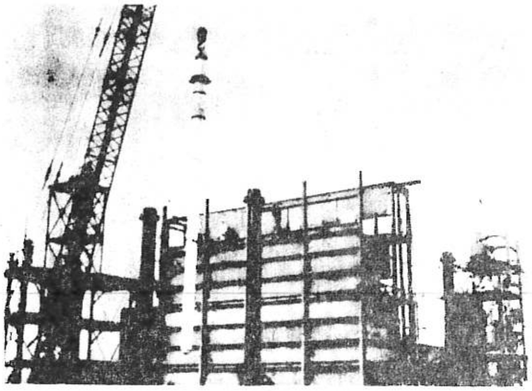
From: Office of Coal Research
Annual Report, Feb., 1967



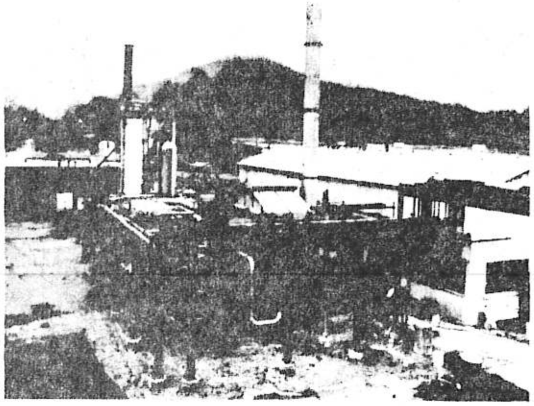
(I) DISTILLATION TOWERS FOR SOLVENT RECOVERY AND PRODUCT SEPARATION



(J) DECANTORS FOR WASHING EXTRACT

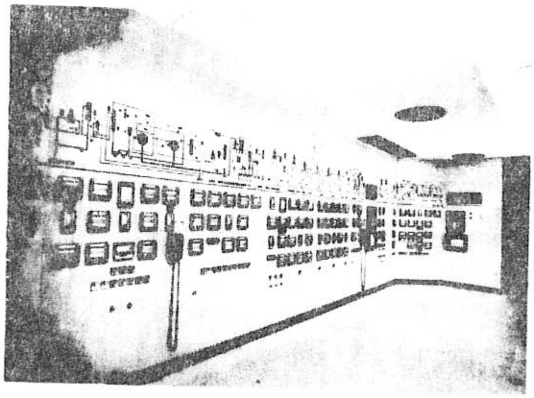


(K) HIGH-PRESSURE HYDROGENATION REACTORS BEING INSTALLED



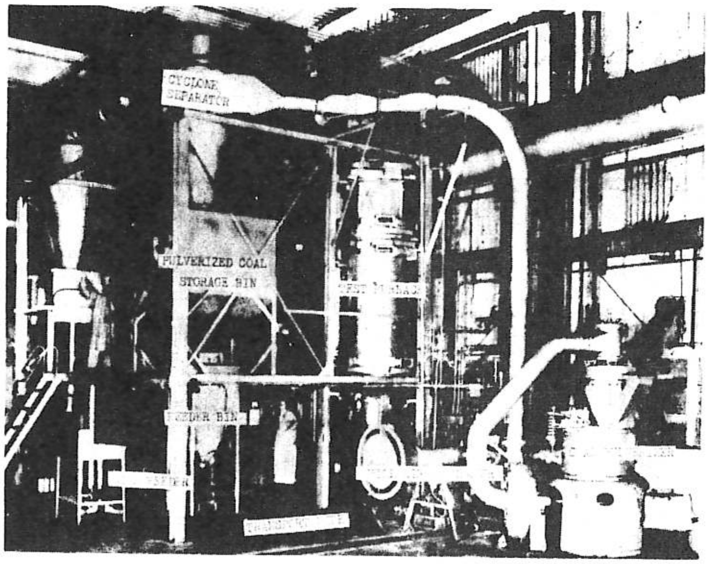
(L) HYDROGEN MANUFACTURING FACILITY

From: Office of Coal Research
Annual Report, Feb., 1967

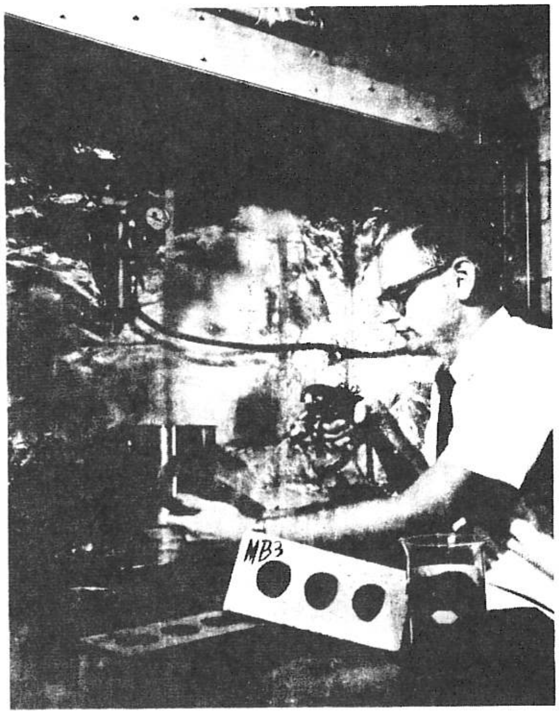


(M) CONTROL ROOM PANEL BOARD

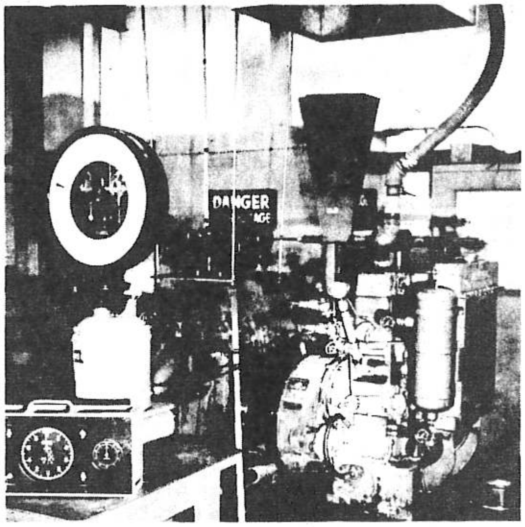
Aerial view of completed pilot plant - Cresap, West Virginia



(N) UNIT FOR TESTING CORROSION RETARDANT COALS



(O) GLAZING FLYASH BRICK



(P) COAL FIRED DIESEL ENGINE

From: Office of Coal Research
Annual Report, Feb., 1967

SHALE MINERAL RIGHT

OWNERSHIP MAP